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REPORTS

FROM

COMMISSIONERS:

TWENTY-FOUR VOLUMES.

—(19.)—

POLLUTION OF RIVERS.

Session

5 February —— *21 August* 1867.

VOL. XXXIII.

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REPORTS FROM COMMISSIONERS:

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TWENTY-FOUR VOLUMES:—CONTENTS OF THE

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N. B.—*THE* Figures *at the* beginning of the line, *correspond with the* N° *at the foot of each* Report; *and the* Figures *at the* end of the line, *refer to the* MS. Paging *of the Volumes arranged for The House of Commons.*

POLLUTION OF RIVERS:

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SECOND REPORT

OF

THE COMMISSIONERS

APPOINTED TO INQUIRE INTO

THE BEST MEANS OF PREVENTING THE POLLUTION OF RIVERS.

(RIVER LEE.)

VOL. I.

REPORT AND MAP.

Presented to both Houses of Parliament by Command of Her Majesty.

LONDON:
PRINTED BY GEORGE EDWARD EYRE AND WILLIAM SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.
FOR HER MAJESTY'S STATIONERY OFFICE.

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COMMISSION.

VICTORIA R.

Victoria, by the Grace of God, of the United Kingdom of Great Britain and Ireland, Queen, Defender of the Faith.

To Our trusty and well-beloved Robert Rawlinson, Esquire, John Thornhill Harrison, Esquire, and John Thomas Way, Esquire, greeting.

Whereas We have deemed it expedient for divers good causes and considerations that a Commission should forthwith issue for the purpose of inquiring how far the present use of rivers or running waters in England for the purpose of carrying off the sewage of towns and populous places, and the refuse arising from industrial processes and manufactures, can be prevented without risk to the public health or serious injury to such processes and manufactures, and how far such sewage and refuse can be utilised or got rid of otherwise than by discharge into rivers or running waters, or rendered harmless before reaching them; and also for the purpose of inquiring into the effect on the drainage of lands and inhabited places of obstructions to the natural flow of rivers or streams caused by mills, weirs, locks, and other navigation works, and into the best means of remedying any evils thence arising.

Now know ye, that We, reposing great confidence in your zeal and ability, have authorised and appointed, and do by these Presents authorize and appoint, you, the said Robert Rawlinson, John Thornhill Harrison, and John Thomas Way, to be Our Commissioners for the purposes aforesaid.

And for the better enabling you to form a sound judgment on the Premises, We do hereby authorize and empower you, or any two or more of you, to call before you, or any two or more of you, all such persons as you may judge most competent by reason of their situation, knowledge, or experience, to afford you correct information on the subject of this inquiry.

And it is Our further Will and Pleasure that you, or any two or more of you, do report to Us in writing, under your hands and seals, your several proceedings by virtue of this Our Commission, together with your opinion on the several matters herein submitted for your consideration.

And We Will and Command that this Our Commission shall continue in full force and virtue, and that you, Our Commissioners, or any two or more of you, may from time to time proceed in the execution thereof, although the same be not continued from time to time by adjournment.

And for your assistance in the due execution of this our Commission, We have made choice of Our trusty and well-beloved Godfrey Lushington, Esquire, Barrister-at-Law, to be Secretary to this Our Commission, whose services and assistance We require you to avail yourselves of from time to time, as occasion may require.

Given at Our Court at Saint James's, the Eighteenth day of May 1865, in the Twenty-eighth Year of Our Reign.

By Her Majesty's Command.

(Signed) G. GREY.

Instructions to the Commissioners.

Gentlemen, Whitehall, May 30, 1865.

Her Majesty having been pleased to appoint you to be Commissioners for Inquiry into the Pollution of Rivers, I am directed by Secretary Sir George Grey to send you the following instructions for your guidance in the proposed inquiry.

Although it may be taken as proved generally that there is a wide-spread and serious pollution of rivers both from town sewage and the refuse of mines and manufactories, and that town sewage may be turned to profitable account as a manure, there is not sufficient evidence to show that any measure absolutely prohibiting the discharge of such refuse into rivers, or absolutely compelling town authorities to carry it on the lands, might not be remedying one evil at the cost of an evil still more serious, in the shape of injury to health and damage to manufactures. It is, therefore, suggested that your inquiry should include selected river basins, illustrating different classes of employment and population; that these river basins might be :—

1st. The Thames Valley—both as an example of an agricultural river basin, with many navigation works, such as locks and weirs and mills affecting the flow of water, and many towns and some manufactories discharging their sewage and refuse into the stream from which is mainly derived the water supply of the metropolis.

2d. The Mersey Valley—including its feeders, particulary the Irwell, as an example of the river basin, most extensively polluted by all forms of manufacturing refuse, particularly that arising from the cotton manufacture and processes connected therewith.

3d. The Aire and Calder Basin, as an additional example of the same class, particularly in connexion with the woollen and iron manufactories.

4th. The Severn Basin, for the same reason, but in particular connexion with the great seats of the iron trade.

5th. The Taff Valley, in connexion with mining and industry applied to metals.

6th. A river Basin comprising a mining district in Cornwall.

Your special points of inquiry should, it is conceived, be in the Thames Valley. 1. The condition of the river as affected by mills, weirs, and locks, and as affecting the drainage of towns and villages and adjacent lands. 2. The condition of the river, as affected both by the discharge of sewage from towns and villages, and the refuse of manufactories, paper mills, &c., and the possibility of intercepting and rendering useful or innocuous these sources of pollution.

As to the other rivers mentioned, the main object of the inquiry should be how far the use or abuse of the rivers is, under present circumstances, essential to the carrying on the industry of these districts? How far by new arrangements the refuse arising from industrial processes in these districts can be kept out of the streams, or rendered harmless before it reaches them, or utilised or got rid of otherwise than by discharge into running waters? In the course of these investigations you will make inquiry into the effect on health and comfort of the existing system of sewage of towns and populous places in the districts examined, and into the best mode of protecting individual and public interests in the purity of running water.

Secondary questions will, no doubt, arise contingent on these leading points, in which case you will include them, as far as it is necessary, within the scope of your inquiry.

I am, &c.

(Signed) H. Waddington.

R. Rawlinson, Esq.,
J. T. Harrison, Esq.,
J. T. Way, Esq.,
Commissioners to inquire into the
Pollution of Rivers.

Letter from H. Waddington, Esq., to the Commissioners appointed to inquire into the Pollution of Rivers.

Gentlemen, Whitehall, July 7, 1865.

I am directed by Secretary Sir George Grey to transmit to you an extract of a letter from Mr. Charles Neate, and to state that it will be desirable to include in your inquiry into the Pollution of Rivers, the subject of the water supply suggested by Mr. Neate, provided such extension of your inquiry will not materially impede or delay the completion of the primary object of the Commission.

I am, &c.
(Signed) H. Waddington.

The Commissioners appointed to inquire into the Pollution of Rivers,
2, Victoria Street, S.W.

Letter from Charles Neate, Esq., M.P., to the Right Honorable Sir George Grey, Bart., G.C.B., M.P.

Dear Sir, House of Commons, June 27, 1865.

I beg to submit to you, with reference to the Commission recently issued to inquire into the means of remedying the pollution of rivers, that as the scope of that Commission has already been enlarged beyond its original and professed object, so as to include an inquiry into the drainage of "lands and inhabited places," it would be right to extend the inquiry still further as to include the great question of the water supply.

Even if the drainage referred to in the Commission is that only which is required for sanitary purposes, it may still be a question whether you might not subject the health of the country to far greater danger by wasting too rapidly the winter supply of water than it now is liable to from the temporary dampness of the soil in certain places.

The effect of drainage, even to the extent it has been already carried out for agricultural purposes, is a subject of serious alarm to many people, and I think it is matter of pressing interest to inquire how far the general level of springs in the country has been lowered, how far it depends upon the height at which the water is maintained in the neighbouring river, and what is the number of springs that have altogether failed, or at least that fail during the summer.

I believe it to be a matter of urgent necessity to provide reservoirs of water throughout the country, to be used for all purposes but drinking, and that the spring water should be habitually confined to that use.

If the Commission, as it stands, is intended to apply to agricultural drainage, the reasons for extending the inquiry are more, still more cogent, for then it is no longer a conflict between one sanitary purpose and another, but between the health of the country and some increase in the productiveness of the soil.

I remain, &c.
(Signed) Charles Neate.

The Right Honorable Sir George Grey, Bart., G.C.B., M.P., &c., &c., &c.

P.S. I think it would be a great point to inquire whether all the surface drainage of towns might not conveniently be kept out of the service and taken into the rivers.

REPORT.

TO THE QUEEN'S MOST EXCELLENT MAJESTY.

We, Your Majesty's Commissioners appointed by Your Majesty's Commission, dated the 18th day of May 1865, to inquire and report as to the pollution of rivers and running waters, and also as to any remedial measures which may be practicable, having on the 29th March 1866 presented our Report on the main stream of the river Thames, proceeded to examine certain rivers and streams in the manufacturing districts of Yorkshire; but, in consequence of representations made to us upon the subject of an outbreak of cholera in the months of July and August 1866 in Poplar and other parts of the district supplied principally by the East London Waterworks Company, which Company derives its water from the river Lee, we thought it advisable to make earlier inquiry into the pollutions of the river Lee than we otherwise should have done. We commenced to make public inquiry on the 10th December 1866, at the Rivers Commission Offices, No. 2, Victoria Street, Westminster, and we continued such inquiry on the 11th and 15th of the same month, and also on the 4th of February 1867. We also, after due notice in the districts, made public inquiry in the towns of

Luton	on	December 12th	1866.
Bishop Stortford		„ 14th	„
Tottenham		„ 18th	„
Hertford		„ 19th	„
Ware		January 16th	1867.

Information has been given to us by the officials and others connected with the River Lee Trust, the New-River Company and the East London Waterworks Company, and by the several local authorities in the towns and places visited, as also by millers, traders, and others. Tabulated returns are appended to the evidence of several witnesses.

In our Instructions, dated 30th May 1865, we are directed to inspect and report, first, on "the Thames valley, both as an example of an agricultural river basin, with many "navigation works, such as locks and weirs, and mills affecting the flow of water, and "many towns and some manufactories discharging their sewage and refuse into the stream "from which is mainly derived the water supply of the metropolis."

The river Lee is one of the northern tributaries of the lower Thames, rising out of springs in Leegrave Marsh, situated in the county of Bedford, and about three miles above the town of Luton. The upper part of the river and its tributaries drain a considerable area of Hertfordshire. From Waltham Abbey to Blackwall the Lee forms the boundary between the counties of Middlesex and Essex. It is tidal from the Thames to Lee Bridge, a distance of about five miles, and is navigable for barges to Hertford, a total distance of 28 miles. The Stort joins the Lee at Feilde's weir, and is navigable for a distance of 13½ miles.

The area of the entire watershed of the Lee is about 500 square miles, or 320,000 statute acres, the dividing ridges to the west, north, and east, ranging from 450 to 300 feet above medium tide level.

The following is a list of the Tributaries from the north, east, and west into the main River, with the Population (as given in the last census) and number of Mills in the basin of the Lee.

	Boroughs, Towns, Parishes, Hamlets.		No. of Mills.
	No.	Population.	
The Lee proper	54	621,102	31
Tributaries north of Lee:			
Mimram	14	10,269	8
Beane	20	13,265	6
Rib and Quin	16	12,374	6
Ash	9	4,638	3
Tributaries east of Lee:			
Stort and Pincey Brook	27	25,064	12
Cobbins Brook	1	2,105	–
Tributaries west of Lee:			
Turkey Street Brook	4	3,106	–
Salmon Brook	9	21,174	–
Moselle	4	19,975	–
	158	733,072	66

Population in the basin of the Lee above point of abstraction (between Hertford and Ware) of the water by the New River Company, exclusive of Hertford, 73,526.

Population in the basin of the Lee above point of intake (at Ponders End) of the water by the East London Waterworks Company 153,030.

The canals which form junctions with the navigable part of the river are:—

Name of Canal.	Point of Junction with Lee.
Lee Union Canal.	Old Ford.
Limehouse Cut.	Bromley.

Towns and Places on the Banks of the River Lee and the Population as given in the last Census.

Borough, Town, Hamlet.	Population.
Leegrave, Beds	426
Luton, Beds	15,329
Wheathampstead, Herts	1,960
Hertford, Herts	6,769
Ware, Herts	5,002
Great Amwell, Herts	1,660
Stanstead Abbotts, Herts	980
Stanstead St. Margaret's, Herts	93
Hoddesdon, Herts	1,898
Broxbourne, Herts	765
Wormley, Herts	572
Cheshunt, Herts	6,592
Waltham, Essex	5,044
Waltham Cross, Herts	2,029
Enfield, Middlesex	12,424
Edmonton, Middlesex	10,930
Chingford, Essex	1,174
Chapel, Essex	370
Tottenham, Middlesex	13,240
Stamford Hill, Middlesex	5,483
Homerton, Middlesex	8,663
Stratford, Essex	15,994
West Ham, Essex	22,337
Old Ford, Middlessx	7,158
Bow, Middlesex	11,590
Bromley, Essex	24,077
Poplar, Middlesex	43,529
	226,088

The geological character of the river Lee basin is shown on a map appended to this Report. From the watershed on the north down to Hoddesdon the area is mostly chalk; from this point southwards towards the Thames the chalk passes beneath the plastic and London clays; in the several valleys the strata are covered by alluvial sand, gravel, and silt. Although the greater portion of the area is described as a natural filter, it is stated in the evidence that out of an average rainfall of 25 inches four-fifths or 20 inches are evaporated. The dry weather flow of the river Lee and its tributaries is described as, for the most part, spring water. The upper portions of the area are seldom flooded; there are, however, heavy floodings in the lower portion. There are also considerable areas of marshy land which arterial and land draining would improve.

The average annual fall of rain is about 25 inches, so that as compared with parts of England on the south and west coasts of Devonshire and Cornwall, or with the northern districts in the neighbourhood of the Solway, where the average fall of rain ranges from 36 up to 60 inches, the climate of the valley of the Lee is comparatively dry.

Mr. Beardmore, Mr. Greaves, and Mr. Muir furnish tabulated returns of local rainfall, which will be found appended to their evidence. It will be seen in these tables that there is considerable variation as to the total volume of rain falling in any one year. An average serves to contrast one district with another district, but taken alone is not a trustworthy guide either for navigation purposes or for water-supply. The test in both cases is the rainfall of the driest years. The wide variation of rainfall is shown in the following extracts from the several tabulated returns.

East London Waterworks.—Mr. Greaves.

		Rainfall.	
1860.	Total depth from January to December - - - - -		32·558
1864.	Ditto ditto - - - - -		15·891

River Lee Navigation.—Mr. Beardmore.

Feilde's Weir, Herts, 90 feet above sea.

		Rainfall.	
1852.	Total depth of rain, January to December - - - -		39·500
1854.	Ditto ditto - - - - -		17·900
1860.	Ditto ditto - - - - -		33·750
1864.	Ditto ditto - - - - -		17·880

New River Waterworks.—Mr. Muir.

Hoddesdon.

		Rainfall.	
1860.	Total depth of rain, January to December - - - -		32·358
1864.	Ditto ditto - - - -		16·405

Enfield.

		Rainfall.	
1860.	Total depth of rain, January to December - - - -		37·125
1864.	Ditto ditto - - - - -		18·490

These returns show as regards the valley of the Lee that in a dry year not quite one-half the depth of rain falls as in a wet year; during dry years much less water flows off the surface of the ground, and spring water is very much reduced in volume. The permanent water capacity of the Lee valley must therefore be measured by the *minimum* volume of rain falling on its surface rather than by the average.

Like the river Thames, the river Lee has been navigable from time immemorial; but whilst on the Thames the navigation works had fallen into ruin, through the abstraction of trade by railways and through neglect, on the Lee the weirs, locks, and other works are at this time in better order, the navigation is more efficient, and the trade is greater, than at any former period. The drainage area of the river Lee, as stated previously, is in round numbers about 500 square miles, the area of the Thames, including the Lee, is about 5,000 square miles, so that the relative areas of the two rivers are as nine to one; but the areas from which water is drawn from the Thames and the Lee respectively for the supply of London are as about eight to one. Five great water companies draw water from the Thames for the west and south of the metropolis, and two great water companies abstract water from the Lee for the supply of the eastern and northern parts of the metropolis. The minimum dry weather flow of the Thames at Teddington lock

is about 350,000,000 gallons of water in each 24 hours, the extreme dry weather flow of water down the Lee at Lee Bridge is little above 40,000,000 gallons in each day of 24 hours. About one-half of the population of the metropolis receive their water supply (some 48,000,000 gallons per day) from the Thames, whilst the other half of the population is supplied with about 38,000,000 gallons from the Lee (as distinct from springs in the valley of the Lee), the New River Company supplying a population of 840,000 persons, and the East London Waterworks Company a population of 675,000 persons; the two companies together supplying 1,515,000 persons out of 3,037,991, the entire population within the metropolitan area. In each case the Water Companies possess statutory powers to draw larger volumes of water than those named, but want of pumping power on the Thames and deficiency of water in the Lee during dry periods have limited the daily volume given in each case up to the present time.

In our first report on the Thames we show that pollution is general from the estuary to the highest point of the main stream. The great intercepting sewers of the metropolis intercept sewage from Hammersmith to Barking Creek on the north side, and from Putney to Crossness Point in Erith Marsh on the southern side, where it is passed into the ebbing tide; the Metropolitan Board of Works has entered into arrangements for the utilization of the sewage on the northern side, and are about to make arrangements for utilizing the sewage on the southern side. By an Act (29 & 30 Vict. c. 89) passed in the last session of Parliament, the Conservators of the Thames received powers to prevent pollution on the main stream of the Thames and of its tributaries for three miles on both sides above Staines, and this session the Conservators have before Parliament a supplemental Thames Navigation Bill, to prevent pollution by sewage from the towns of Richmond, Kingston, Surbiton, East and West Moulsey, New Malden, and Hampton Wick. As in the case of the Thames, so in the case of the Lee, we have found, on inquiry, that pollution of the waters by sewage is general. Details as to this pollution are given in a subsequent part of this Report.

The tidal portion of the Lee and the marshes on both sides of the River Thames were embanked at some early period, beyond any known written or reliable history. The oldest works on the river were the lower embankments, and the earliest works above the tidal flow were no doubt connected with the navigation. Milldams would be constructed at an early date to obtain water-power for grinding corn, and rights of fishing may probaby be as old as any other interest on the river. The earliest population would use and pollute the water to some extent; and as no Conservancy Board has ever had jurisdiction over the entire river-basin, all those portions of the river and of its tributaries not required for navigation or for mill purposes remain, for the most part, in a state of nature; that is, neither embanked nor controlled in any useful way; hence the large areas of neglected marsh-land to be found on both sides of the river down to Lee Bridge. The rapid growth of the metropolis during the last half-century has caused a large increase in the population of the lower part of the valley of the Lee; and as no effective means have been taken to prevent pollution, this has also increased with the growth of population and extension of trade and manufactures. Formerly comparatively little of the water was used for domestic purposes; at present, the entire dry weather volume of the river over and above that required for navigation is taken for domestic and trade purposes.

The lower portion of the Lee valley, where the river forms the eastern boundary of the metropolis, is partially occupied by commerce and trade, but by far the largest area of the watershed above Lee Bridge is agricultural. Luton and the district around have the largest straw-plait trade in the world, and malting is extensively carried on in the towns of Ware and Bishop-Stortford, but in each case the manufacture and trade are principally connected with and contingent upon agriculture. There are water mills on the several streams in the area, but principally on the Stort and on the Lee. These mills are chiefly used for grinding flour; some for crushing out oil. Water-power is used at the Government gunpowder mills near Enfield, and also at the Small Arms Manufactory. There is one small paper mill near Luton. All the water mills on the river Lee, between Ware and Lee Bridge (except the Government mills at and near Enfield, and one at Broxbourne), belong either to the river Lee trustees or to the New River and East London Waterworks Companies. The mills situated on the Stort are private property.

Pollution.—In following the course of the river Lee, in order to estimate its pollution, it may be convenient to consider separately:—

1st. The upper district above the intake of the New River Company at Hertford. 2dly. The middle district included between that point and the intake of the East London Waterworks Company at Ponders End. 3rdly. The lower district to the junction with the Thames at Blackwall.

The upper district contains a population of about 73,000.

The Lee begins to be polluted close to its rise and while yet a slender stream. The first great source of pollution is the sewage and manufacturing refuse of Luton, the largest town in the upper valley, numbering now upwards of 20,000 inhabitants. The town is sewered, and most of the houses in it are drained; and there are at present from 1,000 to 1,500 waterclosets in use. As the result of a compromised litigation with a large landed proprietor in the neighbourhood, the sewage and other refuse, before being cast into the river, are clarified by a liming process. The fresh sewage is mixed with a proper proportion of lime, and the semi-fluid after being so treated is passed into tanks of three or four feet in depth, where a separation of the solids and flocculent matters mechanically suspended takes place; the effluent water more or less clarified flows direct into the stream of the Lee, and downwards to the waterworks and navigation. This process of clarifying sewage improves it in so far as the solids are removed, but the fluid remains sewage, and if allowed to stagnate will become putrid and offensive; mixed with a much larger volume of water and continued in motion it seems to become purer as well as more clarified by the effects of the subsoil, air, and light, and after flowing a few miles the water loses a further portion of the sewage ingredients.

The bleaching and dyeing of straw-plait, the manufacture of which is the staple trade of the town, is undoubtedly a source of very considerable pollution of the water of the river Lee. Large quantities of various metallic salts, dye-stuffs, brimstone, and other objectionable and, in some cases, poisonous materials are, after use in the processes of cleansing, bleaching, and dyeing of the goods, discharged into the stream from which water for the domestic use of a large portion of London is drawn. It is true that the substances so finding their way into the river Lee, though large in quantity in the aggregate, are diluted in the much larger volume of water, and that there are natural influences at work which serve greatly to modify their noxious properties. We learn, indeed, with something approaching to dismay in the first instance, that one manufacturer alone employs from one to two tons of oxalic acid in bleaching straw-plaits, but are somewhat re-assured upon consideration that the poisonous character of this substance is entirely destroyed by admixture with the carbonate and sulphate of lime contained in the water of the river. But the answer to this as to other like pleas for pollution of rivers founded upon the counteracting influences of natural causes is, that we ought not to be dependent upon any such fortuitous protection. No justification of the discharge of these refuse-matters into the river can be offered. There is no reason to believe that they would in any way be injurious to vegetation when mixed with sewage, and although it is shown in evidence that the bleaching, and more especially the dyeing, of straw-plait is to a great extent carried out in detail, and on so small a scale as to preclude separate purification of the refuse, there can be no reason why it should not pass into the sewage, and with the sewage on to land.

The town next in importance to Luton is Hatfield, which contains a population of about 4,300. The plan for disposal of the sewage was adopted with a view to its complete exclusion from the river. But it is essentially a "*dumb-well*" system, and the effect must be more or less to pollute the subsoil water, which after passing through the chalk or gravel subsequently finds its way to the river.

Except at Luton and Hatfield, the sewage of the upper district is not dealt with remedially in any manner. Villages and houses situated immediately on the banks of the stream, no doubt pollute the river; thus we were informed that "Whitwell is a place "where privies hang over the water, and in Welwyn the whole of the sewage runs in." To a certain extent also the river is polluted by sheep-washing, which is carried on upon a large scale. The preparation used for dipping sheep contains arsenic; and when sheep come to be washed months after they have been dipped, the poisonous ingredients, it would appear, remain in the wool sufficient to make the water for the time unwholesome for fish to live in. But from the general district (exclusive of towns on the river and tributaries) the pollution is insignificant, the population being chiefly agricultural. Almost all the water falling upon this part of the Lee basin is absorbed or evaporated. The Lee and its tributaries above Hertford are consequently rarely flooded, and but slight abrasion of the surface takes place, so that scarcely any refuse is washed into the streams.

The middle district, lying between the commencement of the New River at Hertford and the intake of the East London Waterworks at Ponders End, comprises a population of 79,000 persons.

Hertford might seem to be more properly placed in the upper district, because it is a short distance above the point of the commencement of the New River, and formerly

its sewers delivered into the Lee above the same point. But by an Act passed in 1854 the New River Company obtained powers to lay down intercepting main sewers through the town; to construct works for treating the sewage by the liming process; and to convey the effluent water past the New River head into the Lee above the town of Ware. The New River Company have completed these sewerage and outlet works at an outlay of about 22,000*l.* and maintain them; they also subject the sewage to a liming process at a further cost of about 700*l.* per annum, sparing neither trouble nor money. The effluent water usually passes away clear, but being, as it is, the sewage of nearly 7,000 persons, it cannot be otherwise than a nuisance, and it is, according to the evidence, a constant cause of complaint to the people of Ware.

Ware, in its turn, in the disposal of its sewage, shows no consideration for towns below. It is a town numbering some 6,000 inhabitants, and its sewers receive the discharge from upwards of 220 waterclosets, as well as household drainage. This sewage, without any liming or other sort of treatment, is passed direct into the river by several outlets, an arrangement which tends to diminish the local nuisance, but does not diminish the total amount of pollution caused to the river. In addition, the authorities of the town of Ware cause putrid refuse from cesspools to be conveyed beyond the town and there thrown into gravel-pits. The soakage from these masses of refuse must in some degree pollute water in adjoining wells, and also the subsoil water which eventually reaches the river.

Below the town of Ware the Lee is joined by the river Stort. In time of flood the Stort brings down large accumulations of sewage and mud from the towns on the banks above. The chief of these is Bishop-Stortford, a town of upwards of 5,000 inhabitants. Drains are general throughout this town, though main sewers have not been laid down on any proper system; these drains receive and discharge into the river the sewage refuse of the streets, houses, and other places, as also the contents of upwards of 300 water-closets. The effects of this pollution are very sensible at the lower part of the Stort. Mr. Garratt, of Hunsdon-Mill, which is about eight miles below Bishop-Stortford, describes the river as becoming yearly fouler and fouler; every house on the river drains into it; farm-yards also; carcases float on the surface, and the bed becomes silted up with refuse.

At Ware, Bishop-Stortford, and other places on the river Lee and its tributaries, the process of malting barley is largely carried on, and gives rise to a pollution of the streams which is objectionable rather in a local than a general sense. The liquid which results from the steeping of barley to cause it to germinate, is a solution of various vegetable substances, not in themselves injurious, but liable to become offensive by fermentation. The evidence tends to show that this result does frequently occur, and the discharge of the liquid into the rivers is, under any circumstances, to be deprecated. On the other hand this refuse, which is objectionable in the river, would be beneficial to land; and as in most instances the maltsters' operations are carried on in the towns or in close proximity to them, the obvious method of disposal of the steep-liquid is through the sewers on to the land.

Below the junction of the Stort, the towns of Hoddesdon, Broxbourne, Cheshunt, Waltham-Abbey, Waltham-Cross, and Enfield-Highway, discharge sewage into the Lee.

The Lower District commences from the intake of the East London Water-works Company at Ponders End. From this point the river ceases to be a source of water supply, and becomes, in a great degree, like an open common sewer. At the foot of Tottenham Lock is the outfall of Catchwater-Dyke, an open ditch which the East London Waterworks Company under their Act of 1853 have constructed to intercept the sewage of the towns on the west of the Lee for some miles above the reservoirs of the company, and to discharge it below. From this single outlet the Lee receives the sewage of Enfield, Edmonton, Hornsey, Chipping-Barnet, East-Barnet, and Hadley, in its original condition, unmitigated by any process, except so far as it has undergone oxidation in its course along the open ditch. The outlet itself is very offensive in summer. Immediately below are situated the Tottenham sewage works with an outlet into the river Lee. Tottenham is at present a town of some 16,000 inhabitants, having upwards of 2,000 waterclosets, and a water supply of 400,000 gallons per day. The subsoil and open ditches bring the volume of water discharged from the district up to 700,000 gallons each day. The sewage at Tottenham is limed and the solids precipitated, but the effluent water retains so much sewage matter that the Lee Trustees, as protectors of the navigation, and of the health of those employed upon it, have recently obtained from the Court of Chancery an injunction to prevent the Local Board of Tottenham from casting their sewage into the river, so as to create a nuisance.

Leyton, Leytonstone, and Walthamstowe, from the Essex side add, as stated in the evidence, considerable pollution to the Lee.

West Ham, a large and now populous parish, with four-fifths of its houses provided with waterclosets, throws the whole of its sewage into the receding tidal water of the Lee near to its junction with the Thames. The pumping of this sewage costs the locality at present 1,000*l.* per annum. A large volume of sewage at each low water is also discharged by gravitation; but so foul is the river Lee here that we were told by the engineer to the Local Board that this enormous volume of sewage makes absolutely no visible alteration in the river. It should be stated that the discharge at this point into the Lee of the West Ham sewage, is only a temporary arrangement, and an alteration is now under consideration.

Pollution from sewage and refuse of manufactories, notwithstanding the efforts of the Lee Trustees to prevent it, is much on the increase. Large sums of money are spent in dredging out sewage-mud which has accumulated in the bed of the river. The river at Old Ford is rendered very pestiferous during hot weather from the discharge of impurities from large chemical and other works on the banks. The Limehouse cut in summer is also very foul. The district immediately bordering the tidal portion of the Lee has become a nuisance district, the seat of trades expelled beyond the limits of the better parts of the metropolis.

The evils of this pollution are greatly aggravated by two causes, shortness of fresh water in the river Lee and the action (rising and falling) of the tide. The Water Companies now draw direct from the Lee about 38,000,000 gallons of water daily and in consequence, during the extreme droughts of summer, the volume of the river below the intake of the East London Waterworks Company probably would not much exceed the 5,500,000 gallons to which the Lee Trustees are entitled above Old Ford Lock. Thus whilst the pollutions tend to multiply, the water wherewith they might be diluted tends to fail. At neap tides the river is reduced to a small foul stream, oscillating at the bottom of a muddy creek, and there exposes an area of eight acres of oozy mud and sewage deposit, verging into a state of putridity. During the last two summers the engineer to the Lee Trust has thought it advisable not to open the gates at Bow Locks for the receding tide. The flood tide flows through, bringing up vast quantities of refuse from the Thames and the Lee, and being locked in at Limehouse and Bow, deposits the sewage. Thus the evil is ever accumulating.

Sewage of Towns on the Lee.—The variety of systems now in operation and which have been attempted by towns situated within the Lee basin to get rid of their sewage, shows the difficulty that is experienced in dealing with it.

Luton, Hertford, Enfield, and Tottenham have sewage works. At Enfield the solid part of the sewage is separated and the fluid goes to the river; at the other towns the lime process is adopted. Ware, Bishop-Stortford, Edmonton, and other towns pass sewage into the Lee and its tributaries without any attempt at clarification. The visiting justices at Colney-Hatch tried irrigation by hydrants, but it was considered unsatisfactory, though the crops were reported to be good. The British Land Company tried filtration through burnt gravel at East-Barnet; at present the sewage is passed into dumb-wells, but the attempt to get rid of it in this manner is said to be a failure at both these places. At Hatfield the solid matter is first separated and the liquid is allowed to soak into the chalk. The sewage of Hornsey and Wood-Green passes into the Tottenham ditches, there stagnates and creates a great nuisance; that of Chipping-Barnet produces a similar nuisance at East-Barnet.

Cesspools exist to some extent in every town situated within the area; the contents are usually carted on to the land, but the Board of Health of Ware cart much refuse into gravel-pits beyond the town, where it wastes away in the subsoil on the dumb-well system.

Every plan hitherto adopted is unsatisfactory. The lime process does not purify the sewage even when carried out most carefully by the New River Water Company as at Hertford. The discharge of effluent water from these works and *à fortiori* sewage direct from towns into the Lee and its tributaries should be strictly prohibited. The practice of passing sewage into dumb-wells cannot be justified, it must contaminate water to some extent, though it would be difficult to prove it in many cases. The water percolating to the subsoil of the Lee basin liable to this pollution may be used subsequently for domestic purposes. The nuisances occasioned by passing sewage into open ditches shows that any general prohibition against sewage being carried into rivers or running streams should extend to its discharge into ditches and watercourses of all descriptions, although they may be occasionally dry. Open cesspools too frequently partake of the character of dumb-wells, with this important aggravation that they poison the shallow wells near them instead of the water of deep-seated springs. The mischievous

effects of these cesspools on the health of the inhabitants were clearly proved at Luton, Ware, and Mile End Old Town, and such cesspools should be compulsorily closed.

Closets or privies supplied with dry earth or ashes may be adopted where the water-closet system is not introduced; they should be built at least 10 feet from any house, be properly managed, and frequently cleaned out, under vigilant inspection from the local authorities. When these conditions are complied with, they do not injuriously affect the health of the people.

All nightsoil and sewage should be conveyed rapidly and regularly to the land in some way or other; it is a manure too valuable to be wasted as at present; if allowed to remain and ferment among the persons producing it, it is sure to cause disease; on the other hand, nothing can justify the common practice of merely getting rid of it irrespective of the injury and annoyance it may cause to others.

All main sewers and house-drains should be fully ventilated; at Luton, and other towns where a system of sewerage has been carried out without proper ventilation, sickness has invariably resulted from gases entering the houses.

We have received very conclusive evidence as to the success of waterclosets for the poor where they are properly looked after, as at West-Ham and Mile-End Old-Town.

Litigation.—The Lee exemplifies the evils inevitably entailed by absence of river government. Left without control, towns naturally take advantage of running water to get rid of their sewage, regardless of the fact that the process is simply a transfer of the nuisance from themselves to their neighbours lower down the stream; litigation follows; but litigation besides being expensive and breeding ill-will is unsatisfactory. Courts of law are in fact incompetent to deal with the difficulty, and too frequently the party proceeded against may not possess either the legal power or the pecuniary means to provide by permanent works a good and sufficient remedy. The town authorities of Luton are under a perpetual injunction obtained against them by a wealthy landed proprietor in the neighbourhood, which prohibits them from casting their sewage into the river unless it has been first treated by lime. The people of Luton have carried out the injunction strictly, and have remained safe. The New River Company which, as already stated, subjects the Hertford sewage to the same process, and in a still more careful manner, is nevertheless complained of and threatened with litigation by the authorities of Ware. But in both cases the result is the same; the large sums are annually spent in vain, the effluent water remains to all purposes sewage, and, except to the eye, the Lee receives both from Luton and Hertford almost as much sewage pollution as if that process had never been performed. In point of fact, if a river is really foul, it is safer that it should look so.

The authorities of Bishop Stortford resort to singular operations to deliver themselves from their sewage, which the clerk to the Board of Guardians thus describes:

"The nuisance of which the inhabitants have complained from the smell of the river was during last "summer and the summer before, but it was very much abated in consequence of our having wet seasons, "and a plan was adopted that succeeded remarkably well, and that was this: during the summer, when "the water is very short, the filth will sometimes almost crop up to the mouth of the drains, and when "there has been a flood in the winter this accumulation has been stirred up by a barge and a heavy rake "behind, so that we have passed it on to our neighbours to some extent. We thought we had kept it long "enough, and by use of the flood water relieved ourselves from a considerable quantity of stink by that means."

Bishop Stortford has hitherto escaped litigation, but the same witness informed us,—

"We have been threatened by several parties. Our neighbours at Sawbridgeworth have told us that we "have been poisoning them. We have said that we are sorry for it, but we think that they contribute to the "nuisance to some extent themselves, and we have therefore not heeded what they had to say."

Millers on the same stream are almost obliged to resort to similar practices by way of self-defence. Mr. Garratt, of Hunsdon Mill, who has been much troubled with accumulation of mud, says,—

"I find that other people send the mud to me; and I had a large hoe constructed, and I put four horses to "it, and I sent the mud down again into the navigation. It is cheaper than throwing it out."

The condition of the lower end of the valley, where the population is much denser, and adoption of the watercloset system is more general, is of course much worse. Various towns on the Lee, and local authorities on the outskirts of London, have been or are at litigation one with another. To preserve the purity of Edmonton Brook, Edmonton has obtained an injunction against Enfield, and is applying for an injunction against the Trustees of Colney Hatch Lunatic Asylum. Tottenham last year instituted proceedings against Hornsey for fouling Moselle Stream, but although both the fact of the nuisance and the right of Tottenham to relief were equally undoubted, no relief could be given by the law, because there was no public body at Hornsey to be made amenable. The Lee Trustees a few years ago obtained an injunction against the Metropolitan Board of Works, and 820*l.* damages in respect of injury done to the navigation by discharge of sewage from storm-water outlets belonging to the Board. The Lee Trustees also

recently filed a bill against the authorities of Tottenham, to put an end to the nuisance from their sewage works, and especially to prevent the sewage of Wood-Green and West-Green, which are districts within Tottenham parish, being added to the sewage of the rest of the parish, which is now discharged into the Lee. An injunction with costs has been granted, and the consequence will be that the sewerage works of Wood Green and West Green, which the Tottenham Board of Health have just completed at a cost of 9,000*l.*, will be rendered useless; that the population of the two districts will be condemned to fall back on the noxious system of cesspools, already temporarily made; and lastly, that the overflow from these cesspools will be a nuisance not only to the parish, but also to its neighbours; and so perhaps Tottenham may escape from its litigation with the Lee Trustees only to find itself involved in litigation with Edmonton. The only means of putting an end to this litigation is for the Legislature to prohibit throughout the valley the casting of sewage into flowing water, and to create a Conservancy Board whose duty it shall be to see the prohibition carried into effect.

Sewage can very generally throughout the Lee basin be applied to land without difficulty, by gravitation. When pumping is required, towns may fairly be required to adopt it. The purification of the watershed of the river Lee from sewage may involve separate sewerage systems, and also the application of sewage to land for agricultural uses at several points, as at Dunstable, Luton, Stevenage, Buntingford, Bishop-Stortford, Harlow, and several towns and villages in the lower valley, from Hertford and Ware downwards. Schemes to drain all the towns and villages below Hertford would probably be very costly in the first outlay, because the subsoil is so full of water that large volumes of spring and subsoil water would enter sewers and drains in process of formation. On the other hand, under proper control, this abundance of water would eventually be an advantage, as sewage largely diluted is moved to the outlet more quickly and steadily and in a fresher state than when sewers and subsoil are dryer. Combination of the sewerage of towns situated in the higher or middle districts of the valley would involve large and long expensive culverts, whereas small sewage farms would find a readier market for the produce than large farms removed from the population. In the lower valley it may be difficult or impossible to obtain land for sewage irrigation, and it may be expedient, and it is certainly possible, for such towns as Enfield, Edmonton, Tottenham, and other districts, to combine and carry their sewage by continuous sewers either to the Metropolitan outlet or to land in the lower valley of the Thames.

Application of Sewage for Purposes of Irrigation.—In our Report on the Thames, (pages 12 to 15,) we have described at some length the modes of sewage irrigation as practised at Croydon, Norwood, Worthing, Carlisle, and Edinburgh; we have little to add to this account other than that experience confirms the practice of this mode of disposing of sewage. In the course of our inquiry we have received evidence as to its advantage. At this time, April 18th, there are crops of Italian rye-grass at Worthing grown under sewage irrigation, which are being cut at the rate of from five to eight tons to the acre, whilst adjoining pasture-lands are almost bare. A small dairy has been established, the cows being stall-fed on the cut grass; the milk produced, from its richness and superior quality, commanding a preference in the town. A sewage farm requires special and peculiar management; the operations should be specially adapted to this mode of culture, and then it will be found that any land may be improved. The operations do not turn clay lands into swamps, although 60 inches in depth of sewage are added by irrigation to the rainfall. The dressings with sewage must be even and at regulated intervals. In all cases sewage should be used fresh, that is before putrescence has set in, so as to prevent any effluvium arising from the irrigated land. Where this is the case there cannot be any just grounds for complaint. Where clay lands are irrigated, and the contour of the land will admit of the operation, a second and even a third use of the water may be made with advantage.

Sewage irrigation works cannot be too simple in their character; the application should be by surface carriers, not by underground piping and hose and jet. Land which has been worked in ridge and furrow will require levelling, that is the soil should be stripped or the ground be broken up so as to bring the surface even. Main carriers should be laid in nearly level lines so as to command the area below, and secondary carriers at from half a chain to one chain apart should contour the entire surface. The main carriers may be covered in, having valves or sluice-boards of an inexpensive and simple kind to retain and let out sewage as required. The main carriers will be of brick or of earthenware pipes in size proportioned to the volume of sewage to be distributed. Conduits below 18 inches in diameter may be made most cheaply of earthenware pipes: brickwork may be cheaper for conduits of larger cross-sections. Small carriers may be formed with common agricultural tiles, but jointed and laid only three parts in the soil,

so that one tile or more than one tile can be removed temporarily at any point to allow of surface overflowing at such points when the tiles are removed for this purpose. All ordinary conduits may be open trenches, readily formed by hand labour or by the plough. These subsidiary contour gutters must not necessarily be looked upon as permanent. After one sowing of Italian grass has run its course (this should not exceed two years) these minor conduits may be ploughed up with the rest of the land. Some farmers will probably clean the land by taking a root crop off it, and then lay it down again for a second course of Italian rye-grass, and so on. Proper irrigation and cultivation neither fouls the land nor exhausts it. Where sewage irrigation is the cause of a nuisance it will be found to proceed either from use of old and putrid sewage in large and foul open ditch-like carriers, or from open tanks and large carriers being allowed to become foul.

A sewage farm not only requires a peculiar mode of cultivation, but also special management in dealing with the produce. Tolerably good land under sewage will produce from five to seven crops of Italian grass per annum, weighing in the aggregate when green from 50 to 60 tons per acre. A first cutting at Worthing, in May 1865, was from 20 to 25 tons per acre. The grass is used to the best advantage on the day it is cut and is most profitably applied to stall-feeding dairy cows. With such rapid growth and weight of grass a special market for the produce of the land must be provided to prevent waste, failure, and disappointment ; but as milk and butter are a necessity, and as good milk and butter will command a preference in the market, there need not be any difficulty with a sewage farm because of its great productiveness. This has been, however, a complaint made against sewage irrigation in some places—a market did not offer means for immediate sale, the grass spoiled in keeping, and therefore the experiment was pronounced a failure. In course of time sewage farming will become a special business, and when it is found that there is more profit in a sewage farm than in an ordinary farm, the system of sewage irrigation will have been solved. Where there is sewage there must be population. Milk, butter, and beef will therefore necessarily be in proportionate demand; so that, when the true use of sewage is understood, that which is the cause of nuisance by being wasted will be turned to profit on the land.

Floods.—The valleys above Hertford are seldom injuriously flooded, as the chalk subsoil is absorbent, and the gradients are tolerably steep. When floods do occur, the water, though turbid for the time, subsides rapidly and soon becomes clear again. Below Hertford, floods are liable to act injuriously, the water remaining longer on the adjoining marsh lands. Mr. Beardmore stated that heavy floodings had taken place in May 1824, in November 1852, and in October 1857, and that at such times large areas of land were laid under water for several days.

The marsh-lands on both sides of the lower Thames are not subject to such flooding, as the embankments are found to be sufficient to shut out the tides, and the primitive sewers, marsh-ditches, and tidal outlet-sluices regulate the delivery of flood waters so as to prevent injury to land. The marsh districts on both sides of the lower Lee are now subject to the double evil of flooding and droughts; during long continued dry weather the surface cracks until there are fissures several feet in depth. Flood water is passed much more rapidly down the valley of the Lee in consequence of the improvements made of late years in the navigation by dredging the channels. Much, however, remains to be done which would improve the conditions of the marsh-land and the health of the people.

The evidence as to the water-mills proves that in many instances the dams and ponds act injuriously by preventing land drainage and impeding floods. However useful water-power may have been in former times, when these mills were first established, that use has now been greatly reduced in relative value, and, wherever there is sufficient trade to make grinding corn a profitable occupation, steam-power has to be brought in as an auxiliary, the improved navigation and railway accommodation facilitating the delivery of coals so as to give an advantage to steam over the constantly alternating and uncertain flow of water. Water-power having diminished in commercial value, and land for agricultural purposes having greatly increased in value, injury to the adjoining lands may be shown to cause an annual money loss to the district. To this money loss must be added injury to health by the retention of large areas of undrained land. Water-mills and mill-dams are proved to be injurious to local properties, but we have no evidence as to any serious pollutions being caused by these mills, other than so far as they cause a partial stagnation in the water and accumulations of mud by ponding. The rivers are not abused as in the manufacturing districts, by being made the receptacle of solids. Furnace-ashes are too valuable to be so injuriously wasted,

and the River Lee trust is active in preventing abuse and pollution within the extent of its jurisdiction.

Rights of Lee Trust and Water Companies.—The right of appropriation of the water in the Lee is determined by Statute 18 & 19 Vict. c. 196. The general result of these provisions is that the Lee Trust has a paramount right to water required for the purposes of the navigation, and that the remainder of the water is divided between the two Water Companies, practically in equal shares. The priorities are fixed in the following order:—

1. Right of the Lee Trust to pass through their locks,
   - α. For the Upper Reach, extending from the highest point where water is drawn by either of the Companies down to and including the first lock above Feilde's weir, a volume of water not exceeding in any 24 hours 576,000 cubic feet.
   - β. For the Middle Reach, extending from the first lock above Feilde's weir down to and including Waltham Town lock, a volume not exceeding in any 24 hours 720,000 cubic feet.
   - γ. For the Lower Reach, extending from Waltham Town lock down to and including Old Ford lock, a volume not exceeding in any 24 hours 864,000 cubic feet.
2. Right of the Lee Trust to draw such further quantity as shall be necessary, in each pond of the navigation, to maintain the water on a level with the customary head level of that pond.
3. Right of the New River Company to take 2,500 cubic feet a minute.
4. Right of the East London Waterworks Company to take 2,500 cubic feet a minute.
5. Right of each Waterworks Company to take *pari passu* 500 cubic feet a minute.
6. Right of each Company after notice to take *pari passu* any additional quantity.
7. Right of Lee Trust to whole of water below Tottenham mill.

The Lee Trust receives annual payments from each of the two Companies, viz., 1,500*l.* from the New River Company and 2,000*l.* from the East London Waterworks Company.

The New River Company has also contributed 42,000*l.* to the Lee Trust for construction of navigation works.

River Lee Trust.—The navigation of the river Lee, as we have previously stated, is the oldest interest connected with the river. King Alfred is known to have visited Ware by water. Parliament legislated for the Lee in the reign of Queen Elizabeth. The incorporation of the River Lee Trust took place, however, in the session of 1850. On the lower tidal portion from the Thames to Bow Locks, there is a mixed jurisdiction of the Conservators of the Thames, the Essex Sewer Commissioners, and the River Lee Trustees. The total length of the navigable portion, from Blackwall to Hertford, is about 28 miles; the total rise in this distance is 110 feet; there are 20 locks, besides extra locks for flood overflows and minor purposes; up to Enfield the river is deeper and the locks are wider than above—96 feet in length, and 18 feet 6 inches wide—on this part of the navigation barges drawing 6 feet of water and bearing 110 tons can travel. From Enfield to Hertford the locks are also 96 feet in length, some are 16, others only 13 feet wide, and the depth of water is reduced to 4 feet: barges bearing more than 85 tons cannot navigate this upper portion. The oldest locks and weirs were, like those described on the Thames, of a primitive and rude character. Betwixt the years 1770 and 1780, Smeaton improved the navigation, under powers contained in an Act 7 George 3. cap. 57. It was at this period that locks partially constructed of masonry were first introduced. Nearly all these early and comparatively rude works have now been superseded; the existing improved and efficient works having for the most part been designed and executed by Nathaniel Beardmore, Esq., C.E, the present Engineer-in-Chief of the River Lee Navigation.

The navigation is of the utmost importance to the district, as is abundantly shown by its active condition, railway rivalry having failed to injure the river trade as in the case of the upper Thames. We have no hesitation in coming to the conclusion that the navigation of the river Lee must be maintained, as it confers a local value on land, on trade, and on all other property, far greater than the cost of maintaining the existing works. The two great Water Companies, which are now rival claimants for the water, have both come in upon the navigation long subsequent to its establishment

The navigation requires a steady, regulated depth and volume of water, sufficient to supply the locks. The river betwixt lock and lock has in some parts more the character of a canal than the wide open reaches on the upper Thames.

The Lee Trust is an unpaid body, the constitution of which is herein-after described. Particulars as to the state of traffic will be found in the evidence of the Marquis of Salisbury, Mr. Marchant, and Mr. Glass, who are respectively the Chairman, Clerk, and Traffic Manager of the Trust. The Trustees are empowered to raise 230,000*l.* upon the credit of the Trust, of which they have already raised 174,287*l.* The Trust derives its income from tolls, from the annual payments of the water companies, and from the rentals of mills and other property. The whole revenue of the Trust is vested in the Trustees and is applicable to payment of charges and to maintenance of the navigation.

The river Lee Trustees dredge the river, cut weeds, cleanse the channel, and cause floating carcases to be removed from the water—these are seldom, however, seen above Tottenham. There are no rigid rules to prevent or to regulate bathing: the trustees, in fact, act as conservators for the navigable portion of the river as regards its trade only, but not as special conservators for any other purposes. The soil of the bed of the Lee is vested in the Trust, but their legal powers are limited to the navigable portions of the river and to navigation purposes.

Stort Navigation.—The navigation upon the Stort was established in 1769, and is regulated by the provisions of 6 Geo. III. c. 78. The Act empowered the Undertakers to construct the works, and to take certain tolls for the use of the navigation. It also appointed a large number of noblemen and gentlemen as Commissioners, to protect the various interests of land owners, millowners, and others that might be affected. Vacancies amongst the Commissioners were to be filled up by the election of the survivors; the qualification required being the possession of a life interest in land to the amount of 40*l.* per annum, or of personal property to the extent of 800*l.*

The navigation extends from Feilde's Weir near Rye House on the Lee to Stortford, a length of 13½ miles, and is constructed for vessels capable of carrying from 40 to 50 tons each. The annual traffic amounts to about 60,000 tons weight of goods. The navigation has passed into the hands of a private firm, which became entitled to it by foreclosure under a mortgage for 40,000*l.* The body of Commissioners, from the omission to supply the places of defunct members, has become extinct. Great inconvenience ensues. Millers complain of the navigation and the owners of the navigation complain of the millers, and there are no means of redress from the absence of Commissioners authorized to settle such disputes.

The present owners of the navigation have power to dredge, and the expenses of dredging have been greatly increased by sewage thrown into the river at Bishop-Stortford, and at other places. This pollution the owners of the navigation, with their limited statutory rights and in the present condition of the law, are powerless to prevent.

New River Company.—The New River conduit was commenced by Sir Hugh Myddelton in the reign of James I. The source of the New River is in Chadwell springs, but water is now also derived from the River Lee direct, at a point between Hertford and Ware. The drainage area above this point is almost entirely chalk, and in dry seasons the entire volume of water is due to springs. The Chadwell springs vary in volume from 290 to 700 cubic feet per minute. By the River Lee Act of 1855 the volume of water which the company is empowered to take from the Lee is defined, as already explained; this volume has not, however, been taken. The average volume drawn appears to have been about 18,000,000 gallons per diem. The minimum flow at the point of abstraction is stated to be about 27,000,000 gallons. The extent of pollution of the River above the intake of the Company has been already considered under the head of Pollution. Besides the water from Chadwell springs and the river Lee, the New River Company obtain water from wells and borings; one well sunk and bored near the town of Ware has not been used for some time. There are also wells at Amwell Hill, at Cheshunt, and at Hoddesden. There are subsiding reservoirs, 40 acres in extent, at Stoke Newington, and about 8 acres at Hornsey, or 48 acres in the whole. The engineer, Mr. Muir, stated that the amount of sediment in the water was small, as also that the filtering was simply through sand-filter beds, which have been in use since 1856, situated as under:—

Hornsey	2 acres in extent.
Stoke Newington	5 „
New River Head	2½ „
Total	9½ „

New filter-beds of about two acres in extent are in course of construction. Charcoal-filtration has been tried experimentally, but, supposing it to be practically successful, the Engineer estimated that it would cost the company not less than 94,000*l.* if permanently adopted, and that this would be too great an outlay. The Engineer also stated that the New-River Company have, from all sources, a volume of 35,000,000 gallons per day to rely upon, though they have never delivered any such volume. There are at this date upwards of 112,000 houses supplied by the New River Company, having about 7·5 inhabitants to each house, or a total population, in round numbers, of upwards of 840,000, and the demand for water in the locality is increasing. The greater proportion of these houses have waterclosets. The company supply water by meter; at present there are 720 meters in use which register about 2,300,000 gallons per day. The total volume of water delivered per day in December last for all purposes was 22,500,000, which, deducting 2,300,000 used for trade purposes, leaves 20,200,000 as the domestic supply, or about 24 gallons per head of the entire population, or, including water for trade purposes, about 27 gallons each per day. Out of the total number of 112,000 houses supplied, not more than 1,200 or 1,300 are on the constant system; all the rest are supplied intermittently for about 35 minutes, six days in the week; but a large number of the inferior houses have a supply on Sundays. The time the water is turned on seems, however, in some respects to be left to the discretion of the turncock, who is expected to fill the cisterns of ordinary capacity. Some blocks of houses have cisterns, but in many of the poorer parts there are only tubs, pots, and pans, and if from any cause the tenant is not in the way when the water is on, the supply for that day must be begged or stolen. The Company does not hold itself liable for anything but delivering the water; the means of storing the water from day to day, from Saturday to Monday, must be provided and maintained in efficient order by the landlord or tenant; Mr. Muir, the Engineer to the Company, stated that the present arrangements are of a very wretched character. The Company have laid pipes to the doors of the houses, and yet some landlords will not go to any expense in making provision for laying in and storing water. Although, as is shown, the Company pump and pass into the district a daily volume for domestic uses equal to some 24 gallons per head, man, woman, and child, yet by experiments with model lodging-houses, where a constant supply was given for all requirements, the inhabitants, it was found, did not consume more than about 7 gallons per head. At present the eastern part of the metropolis has a daily volume of water poured in, far more than careful experiments prove to be necessary for all purposes, and yet so wretchedly defective are the landlord's arrangements for storing water, that there is a water famine, and the complaints are constant, very loud, and very angry.

The New River, like some other of our oldest waterworks, at first supplied water through pipes of wood. Stone and earthenware were also used for water distribution in these early days: the first cast-iron pipes had flange-joints; now socket-joints are alone used. Some of the cast-iron pipes first laid have been found after 60 years' use perfectly sound. The mains of the New River Company vary in diameter from 36 inches down to 3 inches.

The length of the New River conduit as originally laid out by Sir Hugh Myddelton was about 38 miles, but by cutting off bends, straightening and improving, it is now not more than 28 miles in length. The cross-sectional area is about 75 square feet, and the velocity about four-tenths of a mile per hour; the fall is not more than 1 in 10,000, and the flow is checked by gates and sluices; the bed of the river-conduit is not pitched with masonry or protected by concrete, but is the natural subsoil, with clay-puddle where required.

The New-River conduit is preserved free from pollution. There are fish in it, and all rights to fish are vested in the Company. The soil of the bed of the conduit is vested in the Company, and in some instances the banks also for some distance on both sides.

The present capital of the Company is 3,000,000*l.* sterling, and a dividend a little over six per cent. is paid.

East London Waterworks Company.—The East London Waterworks Company commenced operations by purchasing two old works, one situated at Shadwell, the other situated at West Ham. In 1807 the first Act was obtained, and in 1809 the works were opened, but on a very small scale; the capital, at the outset, being 120,000*l.*; at present the capital is 1,300,000*l.*, consisting of stock, 975,000*l.* receiving 6 per cent., and shares 325,000*l.* receiving 4½ per cent. The dividends in the first instance did not exceed 2 per cent., and from 1820 to 1822 a suspension of dividends took place. The works, when first established, took water from the open river and within tidal influences at Old

Ford. In 1825-26 application was made to Parliament to remove the intake up to Lee Bridge, from which place the water was brought down in an open conduit, and was stored in open reservoirs at Old Ford, from whence it was then pumped for use. The intake is now at a point not far from Ponders End in the parallel of Stonebridge Lock.

The Company have, in station and reservoir area with other land, about 400 statute acres. On a portion of this land a storage reservoir exists capable of containing about 170,000,000 gallons of water or 8½ days' supply, which can be drawn upon during the time the river water is muddy by reason of floods.

In addition to this reservoir the works at present consist of an open conduit from Enfield to Lee Bridge 1¼ mile long, having a cross-sectional area of 100 feet in which the water flows 20 feet per minute; filter beds 12 acres in extent; pure water basin and pumping establishment at Lee Bridge; a cast-iron conduit of 48 inches diameter, capable of conveying 20,000,000 gallons of filtered water per day from Lee Bridge to Old Ford, where there is a covered reservoir, and additional pumping power. There is also water-power for pumping but not on any large scale. There is steam pumping power equal to 1,100 or 1,200 horse-power requiring about 6,000 tons of Newcastle small coal at 12*s.* 6*d.* per ton per annum. The lift is about 112 feet vertical. There are about 500 miles of cast-iron mains, varying from the conduit of 48 inches down to 3 inches in diameter. By the last returns about 90,000 houses are supplied, which at 7·5 per house gives a population of 675,000. The volume of water is about 20,000,000 gallons per day for all purposes, or upwards of 29 gallons per head, or (exclusive of what is taken for trade purposes) about 18½ gallons per head of the population.

The supply is partly constant, but chiefly intermittent. The Company supply water largely for trade purposes, mostly by meters from mains constantly full. Some houses of the better class and some cottage-houses are also supplied on the constant system direct from the mains. Over the greater portion of the district in dwellings above the class of court-houses the inhabitants have tanks or tubs which are filled each day. The supply becomes in part constant in all cases where the Company can treat with landlords willing to make proper storage arrangements in tanks and cisterns, which may be filled each day. The supply of water to house-property of an inferior class is for the most part intermittent, and only on six days in the week, Sunday not being a day of supply. The water is turned on for about half an hour each day; in many of the courts the apparatus is an open wrought-iron stand pipe of about one inch in diameter having no valve upon it, so that the water flows to waste under whatever local pressure there may be when not actually being caught by some one or other of the inhabitants. This defective and unsatisfactory mode of supply leads to great waste of water even during the short period of half an hour. Also the receptacles, where they exist, are often unfit to store the water. Some tanks are placed over the watercloset and dust-bin, and the open tubs stand in small crowded yards, exposed to any dirt, dust, or atmospheric contamination there may be.

Waterclosets are largely used throughout the entire district. At Christmas, 1865, out of 78,710 houses there were 36,214 having waterclosets supplied with water.

With regard to the quality of the water, the water drawn at Ponders End is not of course so pure as that taken by the New River Company higher up the stream, because the river in its course over the intervening space has received additional impurities from towns and places, as already detailed under the head of pollution, but this difference is greatly diminished by the fact that between Hertford and Ponders End the Lee has been reinforced by a large accession of fresh water from the land springs which break out from the chalk into the bed of the river. The result is, as the analyses show, that the East London Waterworks Company are able to obtain a fair wholesome water. The Company have gone to great expense to improve the water before it passes to their filter-beds, by the construction (under statutory powers) of Catchwater Dyke to intercept sewage of certain towns above the intake, and to deliver it at a point below. In a bill now before Parliament the East London Waterworks Company propose an extension of this system of intercepting sewers.

The process of sand-filtration is conducted successfully, though at some seasons under difficulties. A rapid growth of weeds takes place on the sand of the filter-beds, especially during hot weather in summer. The water, as it is delivered from the mains, is proved by the analyses published by the Registrar-General to be equal in quality to the average of the London waters.

Serious charges, however, have been made that the outbreak of the cholera, which in the months of July and August last year took place in the east end of London, is to be attributed to the water furnished by the Company from its reservoirs at Old Ford,

whence the suffering districts drew their supply. We did not consider it incumbent upon this Commission to institute a medical inquiry into all the particulars of this special case, though the evidence we received incidentally bore upon the subject. Suffice it to say that on the one hand the water supplied by the Company at this period from its Old Ford reservoirs had received an admixture of some unfiltered water drawn from an open and partially abandoned reservoir, and that on the other hand there were several local conditions—the low level of the district, the use of polluted wells, the saturation with sewage of the subsoil, and the excessive accumulation of stagnant sewage in ditches and cuts arising in great measure from the storm overflows of the metropolitan sewerage works—the concurrence of which at that season were calculated to produce cholera. Under these circumstances we do not feel justified in attributing the cholera to any one cause exclusively. But the act of the Company in drawing water from the open reservoir for domestic consumption was unquestionably reprehensible. The Company have now entirely cut off all direct means of communication with this source of supply, and we assume that on no future occasion will this water again be resorted to.

Improvement in Water Supply.—With regard to the capability of the river Lee to meet the increasing demand for water supply in the eastern districts of London, the entire volume of water daily drawn direct from the river Lee amounts to 38,000,000 gallons, the New-River Company drawing upon an average 18,000,000 gallons, and the East London Waterworks Company 20,000,000 gallons. In very dry seasons some difficulty is experienced by the latter Company in obtaining their customary volume. It may therefore be taken that no dependence can be placed upon an increase of the supply from the river without the construction of impounding reservoirs on a much larger scale than those now in existence. The construction of such reservoirs has been a matter considered by the Lee Trust and by the Water Companies. The Marquis of Salisbury explained to the Commission a system of impounding reservoirs designed by the late Mr. Rendel for the Lee basin—two to be constructed on the Lee itself, and others on the Ash, Rib, and the Amwell Marsh—capable of holding some 6,212,500,000 gallons of water, a volume sufficient for 140 days' supply at the present rate of delivery from the Lee. It is questionable whether these chalk valleys can afford sites for reservoirs to hold such large volumes of water, unless great expense were incurred in puddling. In Mr. Muir's opinion it would be very difficult to make large reservoirs above Hertford. Extensive reservoirs might with ease be made below the point where the Lee passes from the chalk on to the London clay. The reservoirs of the East London Company, in which there is storage for 170,000,000 gallons of water, cover 120 acres. But reservoirs to hold the volume of water contemplated by the late Mr. Rendel would probably require an area of 2,000 or 3,000 acres; and though large storage reservoirs may be made available to reserve flood waters, yet if, in dependence upon such a store, a corresponding enlargement were made in the area of supply, then, in the event of several dry years following each other, the continued drought would most probably end in the exhaustion of such store, and consequently in temporary failure.

Another question which naturally presents itself is, whether the water of the Lee valley, when its collection and transmission to the metropolis have been surrounded by all practicable safeguards from pollution, will be of such a quality as to satisfy the reasonable wants of the population.

The various streams which contribute water to the river Lee have their sources at considerable distances from each other and flow through very varying soils. Their general characteristic, however, is that given by the chalk, from which the great bulk of the water is derived. That this is so will be seen by the following analyses taken from the different streams during the present month :—

	1 Lee, above Luton.	2 Lee, at Hyde Bridge, above Wheathampstead.	3 Mimram, above Welwyn.	4 Beane, at Watton.	5 Beane, at Stapleford.	6 Mimram, below Hertingfordbury.	7 Lee, below Hertford.	8 Lee, above Hertford.	9 New River, near Ware.	10 Lee, above Ware.	11 Lee, below Ware.	12 Rib and Quin, near Wades Mill.
SOLID RESIDUE in grains per gallon:												
Mineral	24·28	19·17	21·11	22·15	21·78	20·92	19·94	19·57	21·60	20·24	21·28	23·13
Organic	1·04	1·32	0·88	0·88	0·45	0·85	1·09	0·74	0·48	1·18	0·57	0·81
Total	25·32	20·49	21·99	23·03	22·23	21·77	21·03	20·31	22·08	21·42	21·85	23·94
HARDNESS, degrees of Clarke:												
Permanent	5·7	3·4	2·9	3·6	4·1	4·4	3·7	4·2	3·8	4·7	4·3	4·3
Temporary	11·9	13·2	12·7	12·0	12·8	12·4	12·3	10·8	12·0	11·1	12·5	13·1
Total	17·6	16·5	15·6	15·5	16·9	16·8	16·0	15·0	15·8	15·8	16·9	17·4

(*continued.*)

	13 Rib at Hamells Park.	14 Quin, near Braughing.	15 Stort, above Bishop Stortford.	16 Stort, near Spellbrook.	17 Stort, at Harlow Mill.	18 Lee below Wheathampstead	19 Ash, above Waterplace.	20 Lea, navigation above Hoddesdon.	21 Cobbins Brook, near Waltham.	22 Turkey Street Brook at Enfield Wash.	23 Lee, at point of diversion from E. L. W. C.
SOLID RESIDUE in grains per gallon:											
Mineral	24·43	24·05	24·68	26·40	24·68	20·01	22·96	22·05	29·23	18·09	21·82
Organic	1·20	0·91	0·72	1·32	1·37	0·95	2·10	1·25	3·54	2·70	0·97
Total	25·63	24·96	25·40	27·72	26·05	20·96	25·06	23·30	32·77	20·79	22·79
HARDNESS, degrees of Clarke:											
Permanent	3·5	5·5	4·8	4·9	5·4	5·1	4·3	3·8	7·6	7·5	4·4
Temporary	14·6	12·3	12·2	12·5	10·8	9·9	11·5	12·0	5·7	0·6	10·6
Total	18·1	17·8	17·0	17·4	16·2	15·0	15·7	15·8	13·0	8·1	15·0

The samples were collected during the week ending the 17th of April, in this year, and analyzed in the Laboratory of the Commission.

In the third line which shows the solid residue in each gallon of the water, if we omit No. 21, which is altogether abnormal and derived from a stream of small importance, we find the figures to range from 20½ grains to 27½. The same is true of the hardness which, omitting numbers 21 and 22, varies from 15 degrees (No. 23.) to 18·1 degrees (No. 13).

The water (No. 22) from Turkey Street brook is only about half the hardness of the rest of the samples. This stream is evidently supplied in great part by surface water, and it is liable to great variations in volume from flood and drought. The samples are (in common with all chalk or limestone waters) reduced in hardness by boiling. The line of figures set down as "temporary hardness" shows to what extent this softening result is obtainable.

The general similarity of composition in all these samples is very striking, the only deviations of any importance being in respect of the quantity of organic matter. The effect of the contamination of the tributaries of the Lee, by impurity from external sources, is exhibited by contrast with the water of the New River, which contains

less than half the organic impurity found in some of the other samples. The New River owes this superiority partly to its being to a great extent derived from springs flowing direct from the chalk, and partly to the fact that the aqueduct by which it is brought to the metropolis is devoted to no other purpose than that of a water carrier, and is most jealously guarded from pollution in its course. It may not be possible to raise to the standard of the New River the quality of the water of the lower Lee, which has received the Ash, Stort, and other tributaries, draining large areas of clay and liable to frequent floodings; but it cannot be doubted that, if proper measures be adopted to protect the river from avoidable pollution, a great improvement in its purity will be secured.

Such a system of protection of the water of the river Thames has already been inaugurated by the Act of last Session. We recommend that similar protection be secured to the water of the river Lee by the early action of Parliament. The question whether a navigation should be allowed to continue a proper conduit for water destined for the Metropolitan supply is one which deserves serious consideration.

Water Supply of Towns in Lee Basin.—Water is abundant throughout the valley of the Lee. Notwithstanding this, however, some of the towns are badly supplied, and sickness is distinctly attributed to the use of well-water polluted by cesspools. At Tottenham, Edmonton, and other towns the mains of the New River and East London Waterworks Companies are accessible, and are to a limited degree used; but some dissatisfaction is felt at the rates charged by the Companies, and at the exclusive right of the Companies to use the water of the Lee.

Conservancy.—Hitherto, the management of the Lee, so far as there has been a management, has been vested in the Lee Trustees; but as before mentioned, the jurisdiction of this corporation is confined to the navigable channel, and it is only as incidental to their duty to protect the navigation that they possess any authority to prevent pollution or to regulate the height of water and other matters. In their hands the undertaking has been a commercial success; the navigation is well maintained and it is a valuable convenience to towns on the banks and to districts inaccessible to railways; also the river improvements have been found beneficial to the health and comfort of the inhabitants of the valley. Abuses by mills, which in the Thames valley cause such disastrous floodings, have in a great measure been controlled in the Lee. Nor have the Trustees, in the exercise of such powers as they possess for the protection of navigation, been remiss in restraining the pollution of the lower part of the river. Altogether they seem to have administered their Trust well. The Trustees, we are assured by their chairman (the Marquis of Salisbury), consider that without any other change beyond an extension of power, they (the Trustees) are as a body competent to undertake the Conservancy of the river basin for all purposes, and would regard with disfavour any proposition to vest the duties in other hands. To this view we are unable to assent. In our opinion the present constitution of the Lee Trust is not fitted for that of a Board of Conservators.

The present constitution of the Lee Trust is fixed by the conjoint operation of several statutes. By the 16th section of 12 Geo. II., c. 32, the Lord Mayor, Aldermen, and Recorder of the city of London, the Parliamentary representatives of the counties of Middlesex, Essex, and Hertford, and of the city of Westminster, and the boroughs of Colchester and Rochester, were declared to be *ex officio* Trustees, and with them numerous other gentlemen were personally associated as trustees. To these the Act 7 Geo. III., c. 51, sec. 1, added more than 100 others, and further increased the list of *ex officio* Trustees by the Comptroller of the works and revenues of London Bridge, the Mayor and Recorder of Hertford, and the Governor, Deputy-Governor, and Treasurer of the New River Company; and by the 72nd and 75th sections it was prescribed that future vacancies should be filled up by election—the electors to be the Trustees themselves, or any seven of them, and the qualification to be that the person elected should be residing in the same county as that wherein the person whose vacancy was being filled up had resided, and further should, in his own right or the right of his wife, be in receipt of rents of landed property to the value of 100*l.* per annum. By 13 & 14 Vict. c. 109, the Trustees were incorporated. The vacancies as they have occurred have not been regularly filled up, and there are now, we are informed, 67 Trustees, including the *ex officio* members.

The interests which demand representation in any body having the government of the River Lee are, the navigation; the riparian owners; the towns on the banks of the different streams; the traders and wharfingers using the river: both the great Water Companies; the water consumers; the proprietors of the Stort Navigation; and lastly, the Central Government, whose presence at a Conservancy Board is essential to a due regard

being paid to the various interests, and especially to the public health. Some of these interests are no doubt sufficiently provided for by the present Trust; but there are others which have no direct means of making their wishes known.

To add to the Lee Trust, numbering as it already does 67 persons, new members to represent the above-mentioned interests, would in our opinion be to add to a body already far too large, and to render it incapable of efficient working. Still more impracticable would it be to have two bodies; to retain the Lee Trust (whether in an independent or surbordinate position) for the exercise of their present function of regulating the navigation, and to create a Conservancy to watch over all the interests of the river except navigation. Unity of management, so desirable in all undertakings, is, in river administration, an absolute condition of success.

We recommend that the Lee Trust cease to exist except for the purpose of providing electors as herein-after mentioned; that their powers, rights, and property be transferred to a Conservancy Board which shall have charge of all the interests connected with the rivers, and that on that Board the Lee Trust be largely represented. The present staff of the Lee Trust should be retained, and thus the Conservancy would be enabled to start on its career with a complement of officers of local knowledge, long experience, and tried ability. The present Chairman of the Lee Trust would preside over the Conservancy Board, and the leading members of the Trust would continue to be associated with him. But the multitude of those who are now but nominal members of the Trust and who have no real concern in the undertaking would be superseded for all purposes except that of being electors, and be replaced by a limited number of active governors. In this way there might be established a good working body, compact in its constitution and adequately representing all the interests of the river basin.

We would propose a body not exceeding 15 in number, composed as under:—

5 Members to represent the navigation (the first five to be the present Chairman of the Lee Trust, with four of the existing Trustees to be elected by the existing body; future vacancies to be filled up by election by Members of Lee Trust.)
1 Member to be nominated by proprietors of Stort navigation.
2 Members to represent the New River Company, viz., the Chairman, Deputy Chairman, or Treasurer, for the time being.
2 Members to represent the East London Waterworks Company.
2 Members to be appointed by the Corporation of the City of London.
1 Member to represent and be chosen by Traders on the Lee and the Stort.
1 Member to be nominated by the Home Office.
1 Member to be nominated by the Board of Trade.

15

Provision should be made for members to go out by rotation, at fixed intervals.

The exact proportion which in the establishment of the Conservancy Board should be assigned to the various interests represented is not a matter upon which we lay much stress, it is a matter of detail; other arrangements than the one suggested might answer equally well. We contemplate that the need for a representative of the Stort navigation would shortly cease to exist. The Conservancy should have power to purchase the interest of the firm who now own that navigation. In the meantime that interest should nominate a representative to the Conservancy Board, which, in its turn, would not only succeed to the place of the defunct Commissioners of the Stort, but, for the purpose of protecting the river from pollution and the valley from floodings, would receive powers enabling them to control that navigation.

A Conservancy Board, such as we have indicated, would be equal to its duties, and would command the confidence of the public. The interests of the navigation could not suffer in the hands of such a Board, nor would the position of the bondholders of the Lee Trust be injuriously affected; on the contrary it might be improved if, as in our opinion would be just and politic, they received a first charge upon the funds of the Conservancy from whatever source.

In some respects the suggested change of the constitution of the Lee Trust is analogous to the recent change in the management of the Thames. In the case of both rivers the result will be the same, the substitution of a small governing body for a multitudinous collection of nominal governors, and the consolidation into the hands of a single administration of all the powers requisite to be exercised for any purpose throughout the watershed. But the reason for the change is very different in the two cases; in the case of the Lee the motive for change is not past failure of the existing government, but the necessity of wider action for the future; and therefore it is that the modification which we recommend in the Lee Trust is in the nature not so much of an absorption into a new body, as of an establishment on a stronger basis.

The Conservators should be furnished with complete powers. In addition to maintaining the navigable channel and managing the traffic of the navigation, they should be responsible for the due observance throughout the water-shed of statutory prohibitions against the pollution of water which can reach the river, and for keeping the bed and banks both of the river and the navigation in such a condition as to render the channel a fit carrier of pure water to the metropolis. The Conservators should also superintend the execution of works of arterial drainage in the watershed, and would be a guarantee that such works were carried out properly, and not for the benefit of some districts to the injury of others.

With regard to the funds required to meet the cost of the proposed measures, the Lee Trustees have, strictly speaking, no income, the surplus profits of the navigation which remain after defraying the cost of dredging the bed and maintaining the banks of the navigation being applicable to the reduction of the bonded debt of the Trust. However, it is unnecessary to expect that the expenses entailed upon the Conservators would be considerable. The cost of all works of arterial drainage and of works of improvement of the bed or banks of the river in places where it is not navigable would fall not upon the Conservators but exclusively upon the property benefited, the Conservancy being in fact merely a machinery to assist the co-operation of riparian proprietors, and to prevent the opposition of a few being a bar to the execution of works required for the common good of the district. Each town and village would justly be required to bear the cost of all works for the interception of its own sewage from the river, and for the disposal of it by irrigation or otherwise. The chief additional expense created by the institution of the Conservancy would be the maintenance of a staff to see that throughout the watershed the laws and regulations prohibiting the pollution of running water were strictly observed. This expense would rightly fall upon those most interested in the purity of the river, viz., the metropolitan consumers of water derived from the Lee, and these consumers would be most conveniently reached by the charge being in the first instance thrown upon the Water Companies who supply them. The right which the Companies possess to obtain water from the Lee, in such volume and purity as are now attainable, has been purchased by them at large cost. The New River Company has constructed sewers for Hertford at an outlay of 22,000*l.* and maintains the outlet works at a further cost of 700*l.* per annum: and to the Lee Trust it has contributed 42,000*l.* for navigation works, and makes an annual payment of 1,500*l.* In like manner the East London Waterworks Company has constructed the intercepting sewer, called Catchwater Dyke, to protect its intake, and pays to the Lee Trust 2,000*l.* per annum. But this expenditure of the Companies is no objection to a further charge being laid upon them to secure a new gain. To the consumers of water from the Lee—one half of the population of the metropolis—the purer quality of water which the Lee would yield in consequence of the institution of measures to protect it throughout its course, would far more than compensate for the slight addition made to the water rate, which would be required to meet the expense of such measures. Both the Companies, we were informed by their officers, would be not unwilling to make an equitable contribution for this purpose. In fact the East London Waterworks Company are, as appears by their Bill now before Parliament, proposing to protect their intake by constructing additional intercepting sewers —works the expense of which properly belongs to the towns that require them. We therefore recommend that, to meet the expenses of the conservancy, the profits of the Navigation should be supplemented by a charge upon the Water Companies. In adjusting the proportion in which this charge should be borne between the two Companies, regard should be had to the fact that, as compared with the East London Waterworks Company, the New River Company, although they draw a larger volume of water from the Lee valley, draw a smaller volume from the river itself, and that from a higher point in its course, where it is not liable to the greater part of the pollution which it will be the duty of the Conservancy to prevent.

Conclusions.

We now beg most humbly, in this our Second Report, to lay before Your Majesty the main conclusions to which we have been led by our inquiry:—

That the waters of the river Lee and of its tributaries are polluted by town sewage and also by refuse from manufactures.

That there has been much private litigation in consequence of local nuisances, and that the law in respect of pollution of running water is in an unsatisfactory condition.

That portions of the river may be improved by embankments, and that considerable areas of land require arterial drainage.

That there are milldams which injuriously impede the free flow of water, and cause injury to adjoining lands.

That it is expedient that more stringent measures be adopted to protect from pollution that portion of the Metropolitan water supply which is derived from the Lee.

That a Board of Conservancy is required for the river Lee, the Lee trustees having powers confined to the navigable portion of the river, and only for the protection of the navigation.

That the limit of supply of water from the river Lee, available without the construction of extensive storage reservoirs, has been fully reached.

That much of the water now supplied to the metropolis is wasted owing to the absence of proper means of distribution.

Recommendations.

We humbly submit the following recommendations to Your Majesty:—

That the charge of the entire watershed of the river Lee be vested in a Conservancy Board consisting of 15 members, to be appointed as herein-before mentioned.

That the powers and property of the Lee Trust be transferred to the said Conservancy.

That the Conservators receive powers to purchase the Stort Navigation, with a view to consolidate it with the navigation of the Lee.

That after the lapse of a period to be allowed for alteration of existing arrangements it may be made unlawful for any sewage, unless the same has been passed over land so as to become purified, or for any injurious refuse from manufactures or agriculture, to be cast into the river Lee or into any of its tributaries, and that persons offending in this respect be made liable to penalties to be recovered summarily.

That it be incumbent upon the Conservators to see to the enforcement of the prohibitions that may be established against pollution of the river, and that for this purpose power be given to them to visit and inspect works, and, after due notice, to close the outlets of sewers, drains, and discharge-pipes into the river or its tributaries.

That, in the event of the funds derived from the navigation, together with the annual payments now made by the New River and East London Waterworks Companies, proving insufficient to meet the expenses of measures taken by the Conservators for the protection of the river from pollution, the said Companies be called upon to contribute in equitable proportion such further sum as may be necessary, not exceeding a *maximum* to be fixed by Parliament.

That powers be given to the Conservators to make embankments and to drain and improve marsh lands, and carry out arterial drainage operations, the cost of such improvements to be met by a rate upon the properties so improved.

That the Public Works Loan Commissioners be authorized to make advances to the Conservators upon such security as shall seem sufficient.

That Legislative measures be passed to render it compulsory upon each Company to supply water upon the "constant system" throughout its district, and upon owners of houses to furnish their houses with proper arrangements to receive such supply.

All which we humbly certify to Your Majesty, under our hands and seals.

(Signed) ROBERT RAWLINSON. (L.S.)
JOHN THORNHILL HARRISON. (L.S.)
J. THOMAS WAY. (L.S.)

Godfrey Lushington,
Secretary.

May 6, 1867.

BEDFORDSHIRE
HERTFORDSHIRE
CHALK
Barkway
Stevenage
Buntingford
Braughing
Houghton Regis
River Lee
Leegrave Marsh
Dunstable
LUTON
Whitwell
Watton
R Beane
River Rib
Thundridge
Ash River
Ash R
Stort
Bishop Stortford
Much Hadham
CLAY
Sawbridgeworth
Pincey Brook
Welwyn
River Mimram
River Lee
Wheathampstead
Ware
Hertford
New River
River Lee
R Stort
Harlow
Royden
Hoddesdon
Hatfield

GEOLOGICAL MAP

OF THE BASIN

OF

THE RIVER LEE

from Greenoughs England

SCALE OF STATUTE MILES

0 1 2 3 4 5

GEOLOGICAL REFERENCE.

London Clay	i^3	Covered with Brick Earth, Red Gravel and Sands on the uplands and with Surface Clay, Peat, Sandy Clay and from 15 to 20 feet of washed Flint Gravel and Sands in the valley flats
Plastic Clay	i^2	
Chalk	h^6	Covered with Gravel and beds of Fine Sand reposing on the Chalk - the surface being Brick Earth on the flanks and occasional patches of drift Clay on the summits
Alluvium		

Area of Basin about 500 Square miles, or about 320,000 Stat: Acres.

Boundary between New River and East London Water Works District -------

County Boundary —·—·—·—·—·—·—·—

Note !! The black dots (•) show the distribution of deaths from Cholera in the districts most severely visited from June 27th to July 21st 1866.

EXTRACTED FROM CENSUS TABLES OF 1861.

The population in the Basin of the River Lee above point of abstraction (between Hertford & Ware) of the Water by the New River Company, exclusive of Hertford, ... 73,526

The population in the Basin of the Lee above point of intake (at Ponders End) of the Water by the East London Water Works Company 153,030

The population in the Entire Basin of the Lee 733,072

SECOND REPORT

OF

THE COMMISSIONERS

APPOINTED TO INQUIRE INTO

THE BEST MEANS OF PREVENTING THE POLLUTION OF RIVERS.

(RIVER LEE.)

Vol. II.

MINUTES OF EVIDENCE AND INDEX.

Presented to both Houses of Parliament by Command of Her Majesty.

LONDON:
PRINTED BY GEORGE E. EYRE AND WILLIAM SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.
FOR HER MAJESTY'S STATIONERY OFFICE.

1867.

18034.

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MINUTES OF EVIDENCE

TAKEN BEFORE

THE COMMISSIONERS

APPOINTED TO INQUIRE INTO

THE BEST MEANS OF REMEDYING THE POLLUTION OF RIVERS.

INQUIRY INTO THE STATE OF THE RIVER LEE.

Westminster, Monday, 10th December 1866.

PRESENT:

ROBERT RAWLINSON, ESQ., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, ESQ. | Professor JOHN THOMAS WAY.

(*Chairman.*) Gentlemen,—The nature of the evidence which we propose taking is indicated in the following terms:—"Notice is hereby given that the "Rivers Commissioners will hold a public inquiry at "No. 2, Victoria Street, Westminster, on Monday "and Tuesday, December 10th and 11th, relative to "the state of the river Lee and its tributaries. They "will be prepared to receive evidence under the fol- "lowing heads: 1. Pollution by town sewage. 2. "Pollution by other forms of refuse. 3. Nature and "extent of manufactures carried on upon the banks "of the river Lee and streams, and involving the use "or pollution of the water. 4. Cause and extent of "flooding upon adjacent lands. 5. Water supply, "especially as affecting the river Lee and its tributary "streams." Our attention has been specially drawn to the river Lee by letters from the Privy Council Office, enclosing a memorial from a private association formed for inquiring into the defective water supply of the metropolis, and also by an application from the Secretary of the East London Waterworks Company.* If any of the officials of the River Lee Company wish to see the memorial they can do so.

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Mr. E. Bates

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Mr. ELIHU BATES (London) examined.

1. (*Chairman.*) You are secretary to the East London Waterworks Company?—I am.

2. When was that company established?—The bill passed in 1807, and the works were opened in 1809.

3. Do you know what was the extent of the supply in the first instance?—It was very small indeed.

4. Do you know what the capital was then?—The company started by purchasing two other old established works, the Shadwell waterworks at Shadwell, and the West Ham waterworks at West Ham, and entering into the district which had been previously supplied by the New River Company. Our capital I think at the outset was something like 120,000*l.*

5. Then you have increased the capital progressively from time to time?—We have.

6. Up to the present time?—Yes.

7. Do you know what your capital is at present?—If the shares were all paid up (they are nearly so) our capital would consist of 1,300,000*l.*; a small portion of that is not yet paid, but it will be.

8. Did you pay any dividends at the commencement?—Our dividends for a series of years were very small indeed; only two per cent. per annum for a considerable number of years. I am now speaking without book, but to the best of my memory up to the year 1820 the dividends were very small; from 1820 to 1822 a suspension of dividends took place. From that time our dividends have increased, and they are now what may be considered a fair remuneration for the capital employed.

9. What are your present dividends?—Our present dividends on the stock are six per cent. The stock consists of 975,000*l.* out of the 1,300,000*l.* Upon the shares we are paying 4½ per cent. at the present time, which will continue up to 1868, when they will merge into capital the ordinary stock.

10. Have you any power under your Act to recoup yourselves in the first instance for the losses upon the capital embarked?—No special power.

11. Has the loss in the first quarter of this century been considered a dead loss?—Quite so.

12. Then you had no power to consider that in your future dividend?—No, excepting that you may consider that the Waterworks Clauses Consolidation Act enables us to pay back dividends, to make up the dividends to 10 per cent.

13. Have you borrowed any money upon the security of your works?—We owe nothing at the present time. The capital which I have stated is our whole responsibility.

14. And it is all capital upon which you can pay the full dividend?—It is capital upon which we pay the full dividend.

15. Whatever that dividend may be?—Yes.

16. Have you any restriction as to dividend?—Yes, but not in our own Act. I think that the Waterworks Clauses Consolidation Act limits us to 10 per cent.

17. Then if you rise to 10 per cent. you must give extended accommodation, or reduce your rate of charge?—I presume so.

18. Or pay up your back dividends?—Or pay up our back dividends. I am afraid that we are a long way off paying for the past time.

19. Do you know the number of your customers?—About 90,000; we call it 90,000 houses. We give returns monthly to the Registrar-General, which are the true figures as far as we can render them.

20. Of course you know what you supply for domestic purposes and what you supply for trade purposes?—Yes, that is to say we can ascertain the

* Copy of the application will be found printed at the end of he evidence of Mr. Bates, the secretary to the company.

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amount for trade purposes and deduct it from the total quantity of water pumped. Our trade supplies are at present almost entirely through meters.

21. For the means of calculating the sums which are due there is a record of the measure by meters? —There is.

22. There is also a record of the sums paid?—Yes.

23. And you also have a record of the purposes to which the water is put in trade?—Yes.

24. Can a return of the supply for domestic and trade purposes be furnished?—Yes, it can for 1865.

25. Do you supply water gratuitously for any public purposes, such as for fires?—For fires, certainly. As a rule we do not supply water gratuitously for public purposes. There are special cases where we write off rates, for instance, a small affair like the Cholera Hospital in Commercial Street; we wrote off the rate there, but it was only an act of grace.

26. As the evidence which we are now taking will no doubt become parliamentary, I think that it would be advisable that you should state as fully as possible any cases where you have written off the rates?—All hospitals and charities we as a rule supply at half-rate, but I cannot say that we give gratuitous supplies, with the exception of fires, not to any great extent.

27. Do you remember at your board any discussions or objections as to the fouling of your water by river pollutions before you receive it?—No, nothing from outside at all.

28. Amongst yourselves have you had any discussions as to the growing pollution by the extension of buildings above your point of abstraction?—Not as a general rule. The only cases in which such a statement has appeared before the board have been from the reports of our own engineer.

29. I suppose that it is notorious to the outside world, and that it must have been notorious to the company, that pollution has been growing up with the growth of the population?—It has been a growing pollution.

30. Do you know the number of points where pollution now passes into the water supply?—I do not.

31. Have you had any complaints by your customers as to the condition of the water, either this year or previously?—Never.

32. Have you a book containing a record of any complaints made?—We have a book in which we enter every complaint which comes, whatever it may be.

33. Would the company, in your opinion, object to giving us a copy of that complaint book for the last 12 months?—Not at all; you may have the book here and see the book itself.

34. How long have you filtered your water; I presume that you did not filter it in the first instance?—We did not filter it until after the Act passed in 1852. We had some thought of filtering it, but the inquiry which was then promoted by the Government led us to postpone further plans until after 1851 or 1852.

35. Previously to that period the water was supplied as it came from the conduit, and was stored in your reservoirs without filtration?—When our bill first passed we took the tidal water at Old Ford. In 1825 or 1826 application was made to Parliament to enable us to take the water at Lee Bridge. It was conveyed from Lee Bridge to Old Ford in an open canal into open reservoirs, where it was allowed to deposit, and it was thence pumped. In 1852 a further Act was passed enabling us to take the water from a higher source and to divert sewage, and to filter and to supply water partly from Lee Bridge, and partly from Old Ford.

36. To divert sewage from where?—To divert the sewage so as to render the river pure from Enfield downwards.

37. Within the last year or two have you contemplated any proposed extensions of your works, either in reservoirs, or in filter beds, or in engine power, or in any other way?—We have constructed additional reservoirs. We are always liable to be called upon for additional engine power. Our district is growing rapidly, and we have a constant necessity to be looking a-head, and to provide for a further supply, so that our thoughts have been continually upon the subject.

38. Have you land enough in your possession now to make your projected improvements?—We have now 120 acres of reservoir, which we had not three or four years ago. We have obtained that additional land under this power, and can obtain 100 acres further.

39. Do you contemplate having a further bill before Parliament?—We intend to have two bills before Parliament.

40. For proposed extensions and alterations?—Yes.

41. Of course, whatever those bills are, they speak for themselves?—Yes. Here are the notices for them (*producing the same*).

42. And whatever powers you obtain will depend upon what you have applied for, and upon what committees of Parliament will grant you?—Certainly.

43. Therefore that must be in the future?—Yes.

44. Can you state to us briefly what are the powers which you are going to seek?—The engineer will be better capable of doing that than I am.

45. Have you had any analysis made of your water, either in former times or recently, which you could furnish to the Commission?—We have had, during the last two or three years, analyses made monthly by Dr. Letheby. Copies of those analyses are quite at the service of the Commission.

46. We shall be very much obliged if you will let us have copies of those analyses?—You shall have them.

47. (*Professor Way.*) These analyses have been for private purposes; they are not published?—Just so.

48. (*Chairman.*) Have any of your directors, or has your engineer made any special inspection of your works and district for any purpose within the last 12 months? You are aware that it has been said that cholera having been rife in the eastern district which you supply it had something to do with the water?—Yes.

49. Are you aware whether your directors, or your engineer, have made any special examination or inquiry thereon?—The engineer must answer for himself. Our directors have not made any special inquiry personally.

50. You are aware that I personally, with Mr. Taylor, made a very complete inspection?—We had two officers from the Privy Council, Dr. Seaton and Dr. Buchanan, who received all the information which we could give them. That was after the outbreak of cholera.

51. That was previous to my investigation?—Yes.

52. And afterwards Dr. Buchanan accompanied me to your board?—Yes.

53. You say, I think, that you are not aware that the directors either made or advised such an inquiry? —They did not instruct any inquiry to be made.

54. Not that you are aware of?—No.

55. Had you any report from your own engineer? —We have had no report from our engineer as to any cause which should have accounted for the outbreak of cholera in our district.

56. Had you any report prepared indicating the character of the works to meet the charges made by the Registrar-General?—The Registrar-General made a mistake in his first statement, and described our works as they originally had been before the alterations in 1852. I myself called the attention of the Registrar-General to it. The engineer likewise called at his office, and pointed out the incorrectness of his statement.

57. Did the Registrar-General admit that he had made an incorrect statement in any of his documents? —Not fully.

58. Did your board ever receive a copy of the report made by myself and Mr. Arnold Taylor?—No.

59. It was not transmitted to you?—No.

60. You did not ask for it?—We have never asked for it.

61. Did you receive a copy of any report made by Dr. Buchanan and his colleague after their inspection?—None at all.

62. Neither did you ask for it?—Neither did we ask for it. I think that we should have done so if we had known that we could have obtained it by asking.

63. Did it not occur to you that public officers would be required to report?—Yes; but we were never told that the report had been made.

64. If it were in your favour or against you, would it not have been of the utmost importance that you should have known what was said?—We certainly have been very desirous of seeing those reports, whether in our favour or not in our favour.

65. Is there anything which you wish to add to your evidence?—There is nothing further, I think, which I could tell you.

The witness withdrew.

COPY of a LETTER from the Secretary to the East London Waterworks Company to the Rivers Commission, referred to in the Chairman's opening remarks (*vide supra*).

East London Waterworks Company,
Office, 16, St. Helen's Place, E.C.

SIR, 22nd October 1866.

I AM instructed by the directors of this company to ask the attention of the Rivers Commission to the case of the River Lee, and the best means of preserving it from pollution.

By the River Lee Water Act, 1855, the water of the Lee, subject to making provision for the navigation (which is invested in an incorporated body of trustees), and the annual payments secured to the trustees, and also subject to certain other rights specified in the Act, are transferred to the New River Company and the East London Waterworks Company for their respective use in the supply of water in their respective districts.

The companies have from time to time expended considerable sums in works for preventing sewage and pollution coming into those channels of the river from which they take their supply, but what has been done leaves very important portions of the river and its affluents (and portions in which the East London Company is far more interested than the New River Company) without any adequate protection, whilst the evil is, from the rapid increase of the riparian population, daily on the increase, and the East London Company is powerless in the matter.

The directors of the company are desirous to increase their protective powers in this respect, and are willing to face a considerable expenditure with that object, but they are advised that they may probably fail in obtaining the concession by Parliament of the necessary powers.

It appears to this board that it is peculiarly the province of your Commission to inquire into the case, and especially desirable that Parliament should, in dealing with the subject, have the aid of a report from so experienced an authority as your Commission.

I need scarcely point out that there is scarcely a river in the kingdom of which so large a proportion of the waters is devoted to purposes which call for protection from pollution, nor one in which so important a population as that located in the East London district is exclusively dependent for its supply. The River Lee therefore would seem especially entitled to the early consideration of the Rivers Commission.

In these circumstances I am to express the hope of the directors of this company that the attention of your Commission may immediately be directed to the Lee, in the expectation that the case must appear to you one in which legislative protection analogous to that given in the last session to the Thames, should, in the next session of Parliament, be extended to the Lee and its affluents.

I am to add that every information and aid which the officers of this company can give to the Commissioners will be at their disposal, pending the inquiry and afterwards.

I have, &c.
(Signed) E. BATES,
Secretary.

G. Lushington, Esq.
Secretary of the Rivers Commission,
Victoria Street, Westminister.

Mr. CHARLES GREAVES (London) examined.

66. (*Chairman.*) How long have you been officially connected with the East London Waterworks Company?—I was appointed their engineer in the latter part of the year 1851.

67. Had you been connected with them previously?—Not at all.

68. Have you been engineer-in-chief for the whole of that time, or did you act under any other engineer in the first instance?—I was appointed engineer-in-chief at that period and have acted so ever since.

69. Who had been the engineer previously to your appointment?—Mr. Thomas Wicksteed.

70. You succeeded Mr. Wicksteed?—Yes.

71. Do you hold any other appointment?—No.

72. Can you state briefly the extent of your works, the points at which you take your water, and the area of ground which you occupy at Old Ford?—The approximate acreage of land property of the East London Waterworks Company held for the purpose of the works at their several stations, viz., Old Ford, Lee Bridge and Walthamstow, and in Tottenham, Edmonton, and Enfield parishes, is four hundred (400) acres.

73. What is the point at which you abstract your water from the river Lee?—The highest point at which we have absolute control of the channels, so as to call them our own, may be said to be Higham Hill or the parallel of Stone Bridge Lock.

74. Whereabouts is that as regards Enfield; is it on the London side of Enfield?—Yes.

75. How much?—Measuring along the valley, about three miles. Measuring along the course of the river itself, it is about four miles.

76. Have you any jurisdiction over the river or its pollutions above that point?—Other works for the diversion of foul water have been constructed, extending to a greater distance from London, and therefore, although we have not jurisdiction, we have influence over the whole of the river from Enfield Mill downwards.

77. You have legal jurisdiction from the point which you have named downwards?—Yes.

78. You have permissive jurisdiction to a certain extent up to Enfield above that point?—Not permissive.

79. Is it by Act of Parliament you have diverted the foul water?—Decidedly.

80. You have legal jurisdiction there?—Undoubtedly, in that sense.

81. Have you any jurisdiction beyond Enfield up the river?—We have no jurisdiction above, except such as might come under the general Acts which are inefficient in such matters.

82. What is the class and character of the works between Enfield and the point where you abstract the water for domestic purposes; is there any intercepting sewer?—Simply an intercepting sewer which discharges itself into the river considerably below the point which I have named as the source of our special channels.

83. In such a manner as not to contaminate your water in any way?—Quite so.

84. How much of the Enfield sewage does that intercept?—The greater part.

85. Anything besides Enfield?—Nothing beyond Enfield northwards, but southwards very largely; the greater portion of the parish of Enfield, the whole of the parish of Edmonton, the whole of the parish of Tottenham, the whole of the parish of Hornsey, and the whole of the two Barnets, and Monken Hadley.

86. To what extent is the Lee a tidal river, as regards the point at which you abstract the water; does the tide influence it at all up there?—No, those

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points are far above the influence of the tide; the utmost extent to which the action of the tide reaches is between Old Ford and Lee Bridge; the ordinary known limit of the tide is at Temple mills, where posts were erected years ago to show the extent of the jurisdiction of the city; the river is considerably ponded above that, but the tide does not flow upwards.

87. Have you at any point of your works any notorious flooding?—The whole of the valley of the Lee is subject to very great floods.

88. Has it been flooded during the last month?—Yes; the floods have only just gone off.

89. Do those floods reach in elevations so as to get into your conduit?—The conduit brings down flood water. The great flood in October 1857, which was one of the heaviest that we ever had, was up to the top of several of our banks, but the streams themselves were all flood watered at the time.

90. Have you any reservoir room which will enable you to tide over a flood so as to shut out the flood waters and to work without them until the flood subsides?—We have reservoir enough now to enable us to shut out the river for several days.

91. For how many days?—I shut out the river for four days last week. I do not exactly know how far I could go, but I should imagine that I could shut it out for six or seven days if I had occasion to do so.

92. Is the water ever in such a condition that it is advisable to shut it out during flood periods?—It is always advisable to do so when a flood comes on, as a source of economy; it chokes the filter beds so much that it is desirable to shut it out until the river has passed away some of its heaviest suspended matter.

93. Have you sufficient land in your possession to give larger reservoir room so as to shut out the flood water?—I cannot say that we strictly have; we have entered into the purchase of more lands than we have yet made reservoirs upon, but we cannot complete the site for reservoirs without parliamentary power.

94. Will the bills which you have now before Parliament, if they become law, give you a larger area of land which you might use for that purpose?—They will enable me to supply an additional area of about 100 acres.

95. The 100 acres, if turned into water space or reservoir room, will give a very large area of water in proportion?—A very considerable area in proportion to the depth to which reservoirs can be filled.

96. Do you know by inspection the condition of Luton?—Roughly.

97. Does the sewage from Luton go into the river, which water you afterwards take for domestic supply?—Yes.

98. Do you know Bishops Stortford?—Yes.

99. Does the sewage there pass into the river?—Yes.

100. Does the sewage of Hertford also pass into the river?—Yes, the water does, after purification.

101. And the sewage of any other towns above?—There are villages; there are not many large towns. Ware and Waltham Abbey are towns.

102. I assume that you are aware that this Commission proposes to hold a public inquiry at some of these towns forthwith?—I have heard that that is likely to be the case, and I expect that you will do so.

103. Do you think it at all desirable that measures should be adopted, if possible, to prevent the contamination of the waters of the Lee by sewage and foul matters?—Speaking for myself as engineer, and for the company whom I represent, it is a matter of extreme importance that some kind of jurisdiction should be exercised, at as early a period as possible, for the prevention of the discharge of sewage matter into the river, wherever such discharge does ori possible to take place.

103*a*. You have stated that you have certain reservoir room, and you also have filter beds; what is the area of your filter beds?—The filter beds at present in use have 12 acres of sand surface.

104. Do you use the whole of them at one and the same time?—They are all continually in use, with the exception of such as may be under process of cleaning; they are never disused for any other reason.

105. What volume of water do you calculate passes through each square yard of filter bed; what is your mode of calculation for delivery in each 24 hours through your filter bed when it is in good condition?—There is no particular calculation necessary from time to time to ascertain the quantity which is being filtered.

106. But you know what your beds will pass, 1,000 or 2,000 or 3,000 gallons through each square yard or square foot in 24 hours; there is a limit to the capacity of passing water through?—The practical way in which the efficiency or inefficiency of the area of filter bed shows itself is in the depression of the water on the low side. If your filter beds are too small you draw away the water from below because it will not come through fast enough, and it is not desirable to work a filter bed with too much pressure upon it.

107. What is the sectional area of the conduit which brings the water from the river Lee to your filter beds?—The sectional area of the conduit was constructed for 100 square feet; it is filled a little fuller than that measure, and therefore would give an excess on 100 square feet.

108. Of what length is that conduit?—The length of that section is a mile and a quarter.

109. Is the bed of the conduit pitched, or is it the earth of the district?—It is the earth of the district.

110. It is not pitched?—It is not.

111. It is a simple open canal?—Yes, with puddled sides, and formed of the ground at the bottom.

112. Is the puddle so placed that the water has action upon it?—No, the puddle is in the centre of the bank.

113. Is the bed gravel or soil?—It is partly soil.

114. At what velocity do you ordinarily draw the water through that conduit?—The average velocity would be 20 feet a minute.

115. That is about one foot in three seconds?—It varies according to the time of the day, from midnight to midday.

116. Is it a velocity which disturbs the fine particles upon the bottom or the sides, or not?—Far from it; the tendency is to deposit, no abrasion takes place at all from velocity.

116*a*. Do you know what the surface fall is in that mile and a quarter; can you level it?—There is a fall, but it is slight; it would require very nice levelling to ascertain it.

117. How frequently do you find it necessary to clean your filter beds?—Before we constructed settling reservoirs the filter beds required cleansing more frequently than they do now; at present they are cleansed about once in five or six weeks on the average of the year, but the rate of cleansing will depend upon the turbidity of the water and the tendency to vegetate, which differ at different times of the year.

118. According to your experience would your filter beds require more or less cleaning in a wet than in a dry summer?—I should think that a dry summer would create the greatest amount of growth. A balancing of two conditions is not very easy to make; it is a question of degree in each case which one could not be critical about.

119. Is the vegetation which bothers you upon your filter beds more prolific in warm weather or in wet weather?—It is more prolific in hot or warm weather, with a short flow in the river.

120. Do you know the botanical name of the vegetation which so troubles you?—I have not the name of it, we call it "silk weed."

121. What do the navvies call it when they take it off?—They call it "blanket."

122. Did you ever ascertain the weight which you take off at a cleansing?—Never.

123. I assume that it is mixed up with the sand?—Yes; there is very little occasion to take sand off, but

the shovel, which has to be used for taking off the mud, necessarily brings a certain quantity of sand with it.

124. In cleansing the filter beds, are any fish or fish spawn found entangled with the scrapings?—We find a few fish occasionally; fish spawn I do not know of.

125. Does the river Lee contain fish above the point at which you abstract the water?—At the point at which we abstract the water there are numbers of fish in the river.

126. Have you any grates or screens or apparatus for keeping out fish or floating vegetable matter from the river Lee itself at the point at which you abstract your water?—Yes, there are screens erected in front of the channels by which the filter beds are fed.

127. At the junction of the conduit with the river Lee have you any screens?—No.

128. Then anything which the Lee contains is free to come into the conduit at that point?—Yes.

129. And to be brought down towards your filter beds?—Passing towards the sluices where the river is let in there are always accumulations of weeds which are floating down the river; there are many ways in which the trash coming down the river is diminished before reaching the inlet.

130. If there were any dead dogs or cats, or floating carcases upon the Lee, could they float into your conduit?—Possibly at the upper parts, but they would meet with interruption before they got far.

131. Have you ever seen such refuse brought into your conduit?—I have never seen any dead animal in the channels since the present channels have been made. I do not at the present moment recollect ever seeing one.

132. I suppose that your duties do not frequently take you along that channel?—Frequently; if it were a common thing I should have known of it.

133. But I suppose that the river Lee, like all other open channels, is liable to that form of abuse?—People will go and drown dogs at all points of the river, it is utterly impossible to stop it at all points.

134. Are you aware whether there is much bathing in the river above the point where you abstract your water, or is there any prohibition or any supervision to prevent it?—There is bathing here and there, but I think not to any great extent.

134*a*. Have you any means of preventing any bathing near your conduit or reservoirs?—Our own private conduits are fenced to a certain extent.

135. And I assume that you would prevent it?—Of course anything in the form of bathing would be strictly prohibited.

136. You would exercise the provisions of the Waterworks Clauses Act?—Immediately; or we should carry out absolute prevention by taking care that persons should not come there to bathe.

137. In your filtering operations are you troubled most by the growth of the vegetation, or by the actual deposition of mud which is strained from the water in the filtering process; which of the two things bothers you most, the vegetation or the actual sediment of mud?—I should think that the trouble in the operation is about equal. I have never been able critically to decide between the influences of the two.

138. If that vegetation remained long enough would it become offensive?—Not in the filter beds.

139. Not in the water?—Not in the water.

140. Does it become offensive when it is cleansed out and thrown in a heap?—When it is accumulated and thrown in a heap and remains there for any length of time, if the weather is warm and that heap is broken down for cleansing, there is an odour from it which is excessively disagreeable, but in ordinary weather it is not particularly noticeable.

141. That I suppose you cart away?—The filth which is removed from the sand is carted away.

142. You have twelve acres of filter bed in use and your pure water reservoirs from which you pump; have you any conduit or open reservoirs in which water is stored, or into which you can bring water, which are not regularly in use?—I have reservoirs still in existence which were originally made as depositing reservoirs where the simple water is received from the river; those reservoirs until lately were in a position to be drawn upon in the way which you mention.

143. Are those reservoirs capable of being filled by a conduit or by a pipe, would they be filled by sluices directly connecting with the Lee, or by what means would they be filled?—They were capable of being filled by a sluice connected with a disused canal, a canal which was in use as the company's principal line of conduit previously to the year 1852.

144. And that conduit and those reservoirs exist now?—That conduit and the reservoirs exist at present.

145. Are they now full of water?—They have been absolutely severed.

146. Are they full of water?—One of them is considerably depressed and has been emptied, the other one is not full.

147. Are they now in a position so that you could connect them with your lower pumping engines?—No, not now at all.

148. When where they disconnected?—In the last autumn.

149. Could they have been connected this spring?—One reservoir could have been drawn upon this spring.

150. To your knowledge were they or were they not drawn upon this spring?—A small quantity of water was taken out of one of them.

151. Then the water from one or other of those open reservoirs was drawn upon this spring?—Yes.

152. Can you give us the date?—I have not the date.

152*a*. Was it drawn upon by your order?—Not precisely, but there was an implied sanction.

153. For what purpose was it drawn upon? Was it because you were short of water in your store?—I should think that it was because the foreman thought so.

154. He thought that it required it?—Yes.

155. Would he do it without consulting you?—Yes, if I were not present. I lost my foreman early this year; he died quite suddenly of apoplexy, and I had to appoint a new man, and in giving him discretionary instruction as to how he was to manipulate the water, I described this possibility as something which he must keep in mind, rather than suffer an accident, and so I suppose he may have acted in that sense.

156. Do you know about the date when those reservoirs were last drawn upon? Was it before the outbreak of cholera in the east end of London?—I have not the date. I cannot answer that question now.

157. Do you know whether it was or not before the outbreak of cholera?—You mean the last occasion that they were drawn upon?

158. Yes?—I cannot say.

159. Do you remember the period of my visit?—Quite so; it was I think on the 2nd of August.

160. Have they ever been drawn upon since that visit?—Certainly not.

161. Then it was previous to that visit?—Certainly.

162. I suppose that the cholera had been prevailing a month when I visited you?—Yes.

163. Then the probability is that the reservoirs had been drawn upon previously to that time?—Probably June was the latest date, but I cannot say.

164. You did not think it of sufficient importance to ascertain that fact when that charge was brought against your company of supplying impure water?—I certainly did inquire into it, but I cannot give the date now.

165. At this time you say that it is impossible to connect with those reservoirs?—Yes, we have made a barrier.

166. Have you any power to use that water now, if you thought proper, by sluice or by any other means?—No.

167. If your present lower reservoir, the pure water basin, were pumped dry or were run dry, is there no filtration through the subsoil from the old reservoir works to the pure water basin?—None whatever.

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168. What is the relative level of the bed of the pure water basin as compared with the open basin, is it higher or lower, or about the same level?—It is about the same level; it may be a trifle deeper. The river intervenes between the pure water basin and the open one.

169. Then you do not imagine that any subsoil filtration could affect it?—I do not imagine so.

170. Is the bottom of the reservoir pitched?—The bottom is the ordinary natural bottom covered with gravel.

171. Are there any springs in it?—No.

172. When it is empty are there no ground springs?—No; I do not know that it is absolutely tight.

173. Is it all a gravel subsoil there?—No; the greater part of it is the London clay.

174. Then you would have no springs there?—None whatever in the clay.

175. Would it be difficult to give us about the date of the last communication with this open reservoir?—I will find you an approximate date.

176. And do you think that you could give us about the volume of water pumped or the length of time that you used it?—I could do so.

177. What are those open reservoirs filled from, are they filled from the new conduit or from any other connexion with the Lee?—They were filled in one way by the overflow of filtered water from the special filtered water basins. They were also capable of being filled through the line of the now disused conduit, which was a special conduit up to 1856.

178. Was that conduit capable of taking water at a lower point than the new conduit which supplies the filter beds above?—I suppose that it was capable in a certain sense, because every opening which you have as an outlet may possibly be used as an inlet.

179. Could you take water from the river Lee below the point of discharge of the intercepting sewer at Enfield?—Water could have been let in.

180. At a point below the works which you have for separating the sewage of the places which you have mentioned to us from your upper conduit?—Yes, water could have been let in.

181. Do you know whether it was so let in or not?—I cannot know absolutely; it is impossible to know absolutely, but I have no suspicion that it was.

182. Why did you abandon those old works; that is to say, why did you abandon their use and yet retain them?—They were abandoned because the system of filtration, as a matter of course, put them out of use, then they were not applicable to any other purpose, and I thought myself more justified in keeping them full than I was in emptying them, considering that the question of quantity was at times of such importance; with reference to accidents, that it was advisable to keep reservoirs which were already constructed and which I could not apply to any other purpose, to meet such necessities as might arise.

183. Your company carried out the filter beds, and the new conduit, and the fitering arrangements in compliance with the requirements of an Act of Parliament passed in 1852?—Strictly so.

184. That was your purpose and intention?—That was the course of action.

185. That being so, do you think that it was complying with the spirit of the requirement to keep reservoirs which you could use which could not filter the water, would it not have been advisable in your opinion to have abandoned them entirely and utterly?—Perhaps it would. My judgment at the time was, that it was more advisable to keep them.

186. What is your present engine power?—From 1,100 to 1,200-horse power.

187. Did your company use engine power from the first commencement?—Yes; they never had any other means of distributing water.

188. I thought that perhaps in the first instance they might have distributed it to districts which were within reach of gravitation?—Not at all. The company's position, when established, was, under parliamentary power they were authorized to take water out of the Lee, but they were prevented from taking any water but tidal water.

189. Did they pump by steam, or by water power?—The first power erected at Old Ford was steam power, but by the works which they acquired by purchase also at their first establisment at the West Ham Waterworks, they pumped by water power.

190. Do you retain that water power?—The West Ham Waterworks have been discontinued for 15 or 16 years.

191. Was it a tidal wheel?—Yes, there was a small amount of tidal water power, but it was principally river water power.

192. Do you know what water was consumed in the first year of your operations?—I have rough notes which I have drawn into a series for my own use, but I cannot say that it is known with any precision; the early engineers did not keep any correct records of those things, or if they did, they have been lost.

193. What volume of water do you now pump?—It is now about 20,000,000 gallons.

194. What height do you lift the water?—The average lift may be reckoned as about 111 or 112 feet from Trinity high-water mark.

195. What was the character of the mains first used by your company?—I am not aware that the East London Waterworks Company ever laid any wooden pipes of their own, as a proper work; they had such apparatus at the first, but I imagine that it was for the repair of previous wooden pipes.

196. Then they inherited a system of wooden pipes?—They inherited several lines of wooden pipes which had been laid down by the owners of the Shadwell Waterworks and the owners of the West Ham Waterworks, in previous years.

197. Then your company began to lay cast-iron pipes when they purchased the works?—So I have been informed.

198. Had they flange joints?—Yes, put together with bolts, but with a very small number of bolts, as compared with what we should do now.

199. Have you any of those pipes now in use?—I believe that there are a few on one line of pipes not far from where the West Ham Waterworks were.

200. Have you disused all the wooden pipes?—Yes.

201. What were the first house connexions made with; were they made with lead?—I imagine with lead.

202. What are your present connexions?—With lead; lead is the best.

203. Did you ever try wrought-iron?—Yes.

204. What form of joint do you now use in your mains?—Spigot and socket, and lead for all the larger pipes, and iron rust cement for the smaller pipes.

205. What is your largest diameter of main?—Forty-two inches under pressure.

206. What is the size of the smallest?—The size of the smallest main is an empirical point. I do not generally call anything a main under six inches, but still we have some pipes which are here and there used as mains which are only five inches, but those are exceptional. In making up our account we call all over six inches, mains, and all below that not mains.

207. What length of mains have you?—I cannot answer that question off hand, but I can give you the figures probably up to Christmas 1865.

208. What was it then?—I should think 500 miles altogether, for mains and services.

209. What should you call "services"?—Three inches, four inches, and five inches.

210. By the word "services" you do not mean the communication pipes?—No, I mean iron altogether.

211. Is the report by Mr. Austin to the Board of Health in 1852, correct so far as it goes, as applying to that date?—I think so.

212. And with it there is a plan of the area over which you supply?—That plan is correct.

213. But you have extended within that area your means of supply; you have multiplied your customers?

—We have multiplied our customers; we have filled up vacant places; a great many districts then unbuilt upon have since been built upon, and we have spread further into the country.

214. You are now supplying 20,000,000 gallons per day; to what limit could you go; could you supply 30,000,000 or 40,000,000 gallons per day if you had a sale for it?—If I acquired the water I could sell it; I have not the means of supplying 30,000,000 gallons a day at present throughout the year.

215. What volume could you take per day from the Lee with your present means; are you at the extent of it with your 20,000,000 gallons?—No, I am not at the full extent.

216. What would the Lee afford you per day; what would be the probable limit which you could set from the Lee?—There have been times when I have been very short.

217. Even with your present demand?—Yes.

218. Then if London goes on increasing the population must not hope to get very much more from you than you are now giving them?—We benefited our position by the construction of storage reservoirs, of which we had none worth naming at all, until within the last five years; we merely helped ourselves from the river as it flowed, and took things in a state of nature. Any river of such dimensions as the Lee has a great excess of water during a very large portion of the year, and if that water is well stored the supply may be very considerably extended, but without storage and subject to such years as the year 1864, the works are in considerable peril.

219. Will the bills which you are promoting give you additional storage?—An additional 100 acres is covered by one of those bills, and the other bill seeks power to draw 10,000,000 gallons daily from the river Thames.

220. At what point?—Sunbury is the name of the parish where the supply is proposed to be taken out of the river.

221. (*Professor Way.*) Mr. Bates said that you would give us a better account of these bills than he could?—I shall be happy to do so.

222. (*Chairman.*) You propose taking a supply from the Thames above Teddington lock?—Yes, some little distance above the point where the other companies are now taking their supply.

223. If you are met in Parliament by a proposition to bring in water from North Wales, or from anywhere else, upon the plea that you cannot give a sufficient volume, that will be your reply. You are aware that very large schemes for supplying London are talked about?—Yes.

224. And that it has been stated that one of the reasons for those schemes is because a larger supply is required. If you are at the limit with the Lee now in a dry season, and as London has not come to its limit, the question may be asked, where are you to get the additional volume from? and your reply is that you will take 10,000,000 gallons daily from the Thames?—I am proposing to extend our life by helping myself to 10,000,000 gallons daily from the Thames.

225. If you get it?—If I get it.

226. But in the event of your not getting it, would it be possible by works within your reach to get a larger volume from the Lee than you have hitherto got?—I could not execute works which would enable me to make the Lee good for 10,000,000 gallons per day additional, more or less.

227. That is to say in dry weather?—Just so.

228. Probably not by works on your own site, but are there no sites for reservoirs in the upper valley of the Lee?—I do not think that it could be done to the extent of 10,000,000 gallons a day. There are difficulties in the way of finding sites for reservoirs, and suitable soil to make them upon, and suitable rivers to fill them with.

229. Do you know Dr. Angus Smith's patent for varnishing cast-iron mains?—I am acquainted with it.

230. Have you used it?—Not at all. We do not find any necessity for the use of anything of that sort with pipes for the supply of chalk water, or water at all impregnated with chalk; we find that the chalk water puts an enamel on the pipes inside in a most beautiful manner, and which you can hardly imitate; but as a practice, I have had all the pipes which have been sent out for laying lime washed inside for the last 10 years.

231. Is that common limewash?—Yes.

232. Is it sized at all?—No, it is simply a solution of ordinary chalk lime.

233. It is not Portland, or any hydraulic lime?—No; I find that occasionally the pipes when fresh laid become rusty if not drawn upon by any great number of houses, and that the water becomes quite bad, and I find that whitewashing the pipes inside entirely or almost entirely prevents that.

234. Is your supply at present constant or intermittent?—It is a mixture of both.

235. Which portion is constant?—I cannot answer the question strictly, but I suppose that all the mains from 200 to 220 or 230 miles are permanently charged. All large consumers, trades, and manufactories are supplied from them, and they are all of course on constant supply.

236. As regards that portion which is intermittent, how is the intermittent period regulated? Is the supply regular every day, and if so, at what periods of the day?—It is all worked by book; the supply is daily throughout the whole district, excepting such parts as have a constant supply; every day's work is alike, and the work is performed to strict order by the turncocks, who have charge of the letting on.

237. Is Sunday a day with you?—We do not give a Sunday supply to those houses which are supplied intermittently; we have a large number of domestic houses which are supplied on the constant system in addition to the trades and manufactories which I first mentioned.

238. Did you waive that objection to a Sunday supply, and establish it during the prevalence of cholera?—Yes; we gave a very considerably increased supply on Sundays during the prevalence of cholera, but it was not done at random, but with discretion, where we thought it most required.

239. Where the districts are intermittently supplied, with whom do you treat, with the landlords of the lowest class of houses, or with the tenants?—The lower the class the nearer we like to get to the landlord.

240. How is the mode of supply arranged? Do you supply a cistern or tank, or is it by an open stand pipe?—In some courts the water is laid on house by house.

241. Each separate house having a tap?—Yes, and although it is a court, the water is laid on as if it was a street. There are many courts where the water is laid on with a single stand pipe, which is on the intermittent system; the stand pipe being turned on for a definite length of time. There are many other courts where the water is laid on upon the constant system with an apparatus which enables us to control or to prevent inordinate waste.

242. In the courts where an intermittent supply is given, and where the stand pipe is, say, an inch pipe with a turned neck at the top; is there any control as to the waste from that pipe if persons are not catching the water?—Any account which I could give you would not apply to all the courts; they are in all kinds of states and conditions, bad and worse, but we endeavour to prevent a continuance of such things as standpipes without any power of control at all. I am, however, afraid they do exist.

243. For how many minutes is the supply given, 60 or 90?—It is not nearly so long.

244. You turn the water on for a certain length of time?—Yes; say for about half an hour in the courts.

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245. For whatever length of time the water is on, if there is not an individual catching it, is it necessarily wasting?—Yes, if there is no tap.

246. Are you aware whether there are any cases in which there are no taps?—I think, not many. There may be a few, but these things are in such a fluctuating condition, being repaired and getting out or repair, that it requires the attention of several men to maintain the fittings in anything like a proper state.

247. Are the fittings supplied by your company?—The company themselves supply nothing whatever beyond the iron pipe in the street.

248. Then any person wishing to become a tenant of the company must make application and give notice of his purpose to connect; would he make the connexion himself, or would it be done by your workmen?—We make the connexion ourselves; we do not allow anyone to touch the iron pipes, but the connexion is made by our men with the material belonging to the consumer, and with the apparatus of drills and screws belonging to us, at the expense of the consumer.

249. Do you at all dictate the form of apparatus by which consumers shall draw from your works, whether it shall be an open swan-necked pipe, or whether it shall be a stand-pipe, self-acting, or whether they shall have a cistern, or shall be supplied in any other way?—We regulate more or less precisely the fashion of the laying on of every house, and we record it.

250. I saw those swan-necked pipes of an inch bore in some of the courts running full open, and as long as the water was on, there was nothing to check the waste?—It is very likely. I cannot state how many there are, but it is certain that there must be some, because there is no way of making it otherwise. The robbery of brass taps is so frequent that it is utterly impossible to maintain the presence of them at the end of every pipe in every court.

251. Are all your service taps brass taps?—Yes.

252. Have you seen any of the iron service taps recently made by Mr. Lambert?—Yes, and I think we have tried them; but so far as my judgment goes they are not desirable things to use.

253. Do you know how many fire cocks there are on your mains?—I could furnish you with the number of fire plugs which we have. We have not fire cocks, except for private houses. (*The witness subsequently furnished the information, and it will be found printed at the end of his evidence, Appendix No.* 1.)

254. Are they the old fashioned plugs?—The ordinary wooden plugs.

255. Are they provided by the company?—Yes, at the company's expense.

256. Are the fire police at liberty to attach hose to the main at any point where a fire may occur without application to you or your turncocks?—Quite so; they do what they choose to do, we have no denial; they expect the presence of a turncock, but the police are very careless in giving notice to the turncock of a fire which has broken out. If the turncock is there he is ready to draw the plug or to give assistance.

257. Are either one or other of your works in operation so as to give a high pressure in that respect?—Always.

258. What height would the water rise through a hose from one of the plugs in the centre of your district; would it play to any great height without the intervention of a fire engine?—It would depend upon the time of day or night, and the position, whether it is well placed, and whether it is in the neighbourhood of a considerable pipe, or whether it is up a long series of small courts with small pipes, but 25 or 30 feet is a moderate height.

259. Would your service, without the intervention of a fire engine, give you a hose pressure of 25 or 30 feet?—Generally in most places; in many places a great deal more.

260. Is the hose used upon your services without the intervention of a fire engine?—Constantly. The parish of West Ham very seldom use a fire engine.

261. They have a fire engine, and they have a fire apparatus?—They have, but they put out a great majority of their fires by applying the hose through the use of what is called a dummy direct to the pipe.

262. Have you many dead ends on your branch mains?—A good many I should think.

263. Have you any arrangement for washing them out?—In laying a pipe, if the street is finished and the upper end has not to be extended, we put what we call an end fire plug in the line of pipe, that is, a fire plug near the end, the extreme end is generally capped, and when we think or know that there is any occasion for washing the pipe we discharge water through it into the street.

264. You draw the plug?—Yes.

265. As a rule, do you find the water bright or not in your dead end pipes?—The water is now generally bright, but there are occasions when there is an accumulation of sediment at the dead ends which must be blown out, by washing out. The mains are generally looped together, whenever it is possible, so that parts may be shut down for the purpose of making new connexions without interfering with everything.

266. Have you reason to believe that you have much or little leakage from your mains?—I do not suspect any leakage at all from the mains. I think that the mains are quite tight.

267. Have you any ready means of ascertaining where the leakage is, if there is one?—No; if a leakage takes place into the sewer, it may go on for a length of time without our having any knowledge of it, except the knowledge which we might have of an inordinate increase in the flow, but in 20,000,000 gallons a day that would not show itself.

268. Have you at any point any incrustation in your mains?—No.

269. You never have anything like this (*producing a piece of pipe deeply incrusted*)?—Never. I have never seen anything of that sort from chalk water. I should imagine that that would be a deposit from boiled water, and not from cold water.

270. That is a part of the supply for an ordinary city service, and it has been 38 years in use in the city of Bath?—We have nothing of the sort. I took up several of the pipes of the West Ham service in 1862, which had been there since 1762, and there was not the eighth of an inch incrustation anywhere.

271. Have you bursts occasionally in your mains?—Occasionally.

272. Do you find that bursts take place after a main has been working several years, or is it generally in the first year of its life?—Bursts generally arise from defects in pipes, and therefore may be probably expected to be proved in the first year's use, but bursts sometimes are occasioned by frost, or by weakening occasioned by frost.

273. Are your mains laid at such a depth as to come within the influence of frost?—Yes; when frost is extreme.

274. What is the greatest and least depth of covering for the pipes?—The rule is, two feet above the barrel of the pipe, but there are cases in which it is frequently less.

275. Have frosts touched them at that depth?—Yes; in certain cases. In the last very cold weather which we had, several of the pipes burst. A particularly cold wind in that winter seemed to catch the ground in certain places, and the frost went very deep.

276. Would an open end so as to give a motion to the water in the pipes, be an advantage?—I do not think so.

277. Was there anything to prevent your laying those pipes at a greater depth?—On the average, 2 feet is deep enough. The number of breakages is not great, and the depth at which pipes are laid has to be regulated for the convenience of the consumer's pipes. The expense is generally increased by going to a greater depth, and that has become the depth which we have considered sufficient.

278. Do you know how many gas companies

there are in your area? Is there more than one?—Yes.

279. Are you at all bothered with their pipes interlacing yours?—We have had to grumble and squabble and fight several times with the gas companies on account of the proximity of their pipes.

280. Have you any rule as to the nearness at which water pipes and gas pipes should be laid?—We have clauses in our Act of Parliament which restrict them from coming within a certain distance, and which orders the way in which pipes should be put together so as to escape as much as possible the chances of contamination.

281. Do you use puddle, or cause them to use puddle, if they come near you?—No, we have never done so. Of late years the contaminations which have commonly occurred have been very few indeed, scarcely any.

282. Are you aware that in some parts of the metropolis, if not in yours, the water pipes and the gas pipes literally interlace each other?—I am aware that they do, and I do not see how it can be otherwise.

283. The external surfaces of the pipes are in contact?—I dare say that that is so, but with mains and pipes constantly charged there is not much danger, it is in pipes which are used for a daily supply, that the danger exists.

284. Where the supply is intermittent would there, or not, be danger?—There would be danger. I have heard of gas burning at the mouth of a supply water pipe.

285. Then it forms a gas pipe as well as a water pipe?—Yes.

286. Are you at all troubled with blown joints?—Not much.

287. I suppose you occasionally have a blown joint?—Occasionally, especially if there is an excess of pressure. We have had a little trouble under those circumstances, but with our ordinary pressure, which is by no means an excessive one, we are very well as to joints. I should have to find fault with our pipe laying contractors if we had any frequency of blown joints, but we have not.

288. Do you lay by contract?—Yes; entirely.

289. What depth of lead would you give to a six-inch pipe?—About two inches and a half, or not much less.

290. Do you think that an intermittent supply is more wearing upon joints and pipes than a constant supply, or otherwise?—With our pressure I do not think it makes any difference. There is no stress which need be talked about with a pressure not exceeding 120 feet.

291. Do you supply the whole of your water by means of a stand pipe, or do you ever pump directly into the mains?—It is all pumped directly into the mains.

292. Does not the opening and shutting of the valves affect your engines?—Not in the least. If a maincock in the neighbourhood of the works on the principal line of pipes were opened or shut it would quicken or slow the engines, but such openings and shuttings as those, are done by a man of ours especially employed.

293. Your engines are balanced?—Yes, they are all balanced against a certain height of hydrostatic pressure. They are upon the Cornish principle.

294. Have you safety valves to blow off when the pressure is exceeded?—No.

295. Do you know what number of houses you serve?—The most authentic return is that made to the Registrar-General monthly, in which the number now somewhat exceeds 90,000.

296. Do you know the volume which you supply for trade, and the volume which you supply for domestic purposes?—The volume of water delivered for trade purposes being entirely delivered through meter is known to a nicety.

297. Then you will probably let us have the number of meters, and the volume supplied through them?—Yes.

298. What is your price by meter?—There are three prices.

299. Is it according to the scale in your last Act of Parliament?—Yes.

300. Does that Act also regulate your domestic supply?—The domestic supply is by a per-centage on the annual value.

301. Is it 5 per cent.?—Yes.

302. Have you a separate supply for waterclosets or soil pans?—There is a separate charge.

303. That is all stated in the schedule?—Yes.

304. A copy of which schedule we can get?—A copy of which schedule we can furnish you with.

305. It will also state whether you make a separate charge for watering gardens, or watering streets, or any purpose of that sort?—Yes.

306. Do you charge for the water supplied for watering streets?—Yes, that is all done by meter.

307. Have you any idea how many waterclosets and soil pans there are in your district?—I have not the precise knowledge, but I have an approximate knowledge of the number of closets which exist in the houses which are supplied.

308. What is that number?—You must allow me to refer to papers for that, because these are not subjects which are often brought forward, and it is a matter of statistical knowledge which can only be furnished by looking particularly into it.

309. We should very much like to have it if you could tell us the number within 1,000?—I do not think that I could give it to you all over the area, but I could select a district vestry or a board of works, and I could tell you how many houses of the total number of houses, within that district, had water supplied to closets, and how many had none, because where there are closets and no water supply, we have not made an account of the closet pans. (*The witness subsequently furnished the information, and it will be found printed at the end of his evidence, Appendix No.* 2.)

310. But if you have 90,000 private consumers you would know whether you have 20,000 or 30,000 waterclosets?—Yes.

311. Would they amount to 40,000?—I should think more.

312. We do not care even to 1,000, but we should very much like you to give the number in round figures?—I will do my best to furnish you with that information. In 78,710 houses situate within the metropolitan district of the company there were, at Christmas 1865, 36,214 having water fittings to the closets.

313. Do you know anything about the sewerage which is carried out in your district? Have you any plan of the main sewers?—I have no plans but the general plans. We have laid down on such maps as we use the lines of the main sewers, but we have never endeavoured to lay down the lines of the smaller sewers on a system generally.

314. You keep, I presume, for your own purposes, separate plans of your own mains?—Precisely, both of the mains and of the services.

315. On what plan are they recorded?—On the 5 feet ordnance plan.

316. Do you use the skeleton ordnance plan, or the other plan?—We use the detailed 5 feet ordnance plan. It requires hundreds of sheets to fill up the whole system of piping, and we keep it posted up as early as possible. I like to correct it every year if it can be done.

317. What meter do you use for sale?—We have been entirely using Siemen's patent.

318. Do you find that it answers to your satisfaction?—I have every confidence in it.

319. In the event of its measuring intermittently would it not measure air as well as water?—If air were blown through it would revolve, and the index would count, but all meters are on constant supply.

320. Then the only time when they would be on intermittent supply would be in the case of repairs

or of additional services being put on in your district?—Yes, if the main was emptied there would be a possibility of air being blown through the meter.

321. And the parties would have to pay a little extra?—Yes.

322. Do you know the number of meters which you have in use?—I think that is 1,200.

323. How long have you adopted the meter system of supply for private purposes?—I think that we began the meters in 1855.

324. Do you find that system advantageous?—In every way.

325. Is it equally satisfactory to the consumer?—That is rather a difficult question to answer. The consumer wants to get the most which he can for the least money.

326. At all events he is supposed to get what he pays for, and not to pay for more than he gets?—Certainly, and he does not pay for more than he gets; and in the case of any consumer who treats with us on the common ground of honesty we have no difficulty. He admits that the meter is the fairest mode and far more fair than any estimation which can be made by the judgment of an officer.

327. What was the mode of supplying for trade purposes previously to the introduction of the meter?—The duty of estimating the quantity was committed to a special officer whose department included that work and he had to get at a knowledge of it in the best way that he could, and the methods of doing so were most imperfect and most inefficient.

328. Did he apportion the bore of the service to the requirements or was it a mere guess?—In many cases he tried how much was delivered at a house with the pressure and with the sized pipe. In many trades we got into the system of estimating according to the work done. Brewers were supposed to require a certain quantity of water to brew with, and the same with spirit manufacturers. If dyers turned out a certain quantity of goods they were supposed to use a certain quantity of water, and it was the same with all of them formerly more than now. Within certain limits there were the means of knowing what amount of goods they turned out, and a certain quantity of water was allowed to so much work done.

329. Do you now supply water for brewing?—Largely.

330. And for dyeing?—Yes.

331. Where are the dye works situate?—In various parts of the district.

332. What kind of dyeing is it?—I can hardly describe it to you.

333. Is it in connexion with Spitalfields weaving?—Yes, silk dyeing. They are small trades, they are not very large.

334. But you do supply dyers?—There are several dyers on our books.

335. And for condensing purposes for distilling, you supply water?—Yes, very large quantities, and also for condensing purposes, for sugar baking, for the production of vacuum.

336. Do you also supply water for steam engine boilers?—Yes, largely. We supply water for any purposes for which the people can use it, and since the adoption of the meter system, it is of little consequence to us how they use it, or for what.

337. Would it be difficult for you to let us have an approximate list of the different trades for which you supply water; if you have 10, or 15, or 20 trades of the same kind. I do not want to know how many cases there are of each trade, but I want a statement of the kinds of business carried on for which you supply water by meter?—I think that we can give you a pretty near account of it. (*The witness subsequently furnished the information, and it will be found printed at the end of his evidence, Appendix No.* 3.)

338. (*Mr. Harrison.*) We should like to have the quantity of water used for the production of the kind of material?—I do not think that we could do that at all.

339. I thought you said that it was the duty of a special servant to determine the volume of the water used?—That was 10 years ago, but I do not think that those data would be reliable.

340. (*Professor Way.*) I suppose that more water is used in your district for trade purposes than in any other part of London?—No returns since 1852 have been at all minute. We do not know what the quantities used in other districts are, but we imagine that our supply for trade purposes is as large as any.

341. (*Chairman.*) Do you at all supply by meter for domestic purposes?—A few houses.

342. Have you ever made any experiments yourself to test what is the daily consumption for domestic use? If you are told that in a town the domestic supply is 20 gallons per head of the entire population, do you believe that any such volume is legitimately used?—I believe that that is what is used in our district.

343. Used or wasted?—Used or wasted, I believe that it goes to the domestic supply.

344. Did you ever set up any experiments to find out what would be a legitimate use, and what would be an improper use?—Yes, I have investigated the matter a good deal. The experiments which I have made are only such as metering a district and dividing the quantity supplied by meter by the number of houses in the district.

345. What did the result turn out to be in that case?—When we had measured various districts some of them were bad and some were good, some of them gave much more than we ought to be delivering and some of them scarcely gave enough.

346. (*Professor Way.*) In that experiment, I presume, the parties would be paying by meter?—No; it was a meter put in at my own instance to obtain a knowledge on the subject.

347. Did they know that the water was being measured?—In some cases they did. In some cases where the quantity was excessive we had to tell them that they were using a great deal more water than they should use, and their first inquiry was, "How did you know it?" and that found out the experiment.

348. The experiment would have some elements of fallacy?—It is a very difficult thing to know precisely.

349. (*Chairman.*) Whatever the volume of water is, which you use, you may make a rule of three sum of it with regard to the coal you use, the volume representing the coal or the coal representing the volume?—According to the condition in which the engines are; there is a pretty uniform correspondence between the amount of coal and the water.

350. What is your present annual consumption of coal?—About 6,000 tons per annum.

351. What coal do you use?—Entirely small Newcastle coal.

352. Do you find the coal yourself?—No.

353. At what is it laid down at your place?—The present price is 12*s.* 6*d.*, those are the siftings of house coal.

354. What is called slack?—We call it slack, but it is not correctly called slack, because slack in the North means some inferior stuff which comes from the shale.

355. (*Mr. Harrison.*) Is it what in the North is called nuts?—Nuts are too coarse, but we use the fine siftings of Firsts and Seconds.

356. (*Chairman.*) Do you think that 6,000 tons of coal per annum represent the lift of 20,000,000 gallons of water per day 112 feet?—It would go on for a few years correctly, if the engine is not suffering any damage, or has not any great improvement, and I suppose that it would remain pretty uniform.

357. Have you any tabulated record of work done per month, or per cwt., similar to that which is kept by the Cornish engineers?—Yes, I have it for some of the separate engines, and also for the whole power which is in use.

358. Could you let us have an extract from that

record showing the results of your own experience?—I think that I could make a table. Taken in the gross it would be mixed up with a certain amount of water power, and it would have in it some steam power doing special work. I could give you an approximate idea on the gross.

359. Do you ever require to cleanse the open conduit leading down to your filter beds?—Yes, it is desirable to cleanse it frequently.

360. What is taken out of it when it is cleansed?—Deposit mud and growing weed.

361. If it were made into a tunnel and the light shut out, and pitched the whole length, do you think that it would bring down cleaner water?—No, I do not think that it would improve the water at all. Until water is filtered I do not think that it is advisable to enclose or cover up or shut up water. I think that the action of the light and air upon it produces more benefit than detriment.

362. Have you had any experience of enclosing water, and seeing its condition after such enclosure? Have you ever to cleanse or examine the cast-iron conduit which connects your upper filter beds with your lower pure water beds?—No.

363. Have you any ventilation upon that line of pipe?—There is a ventilator at ever furlong.

364. Was it ventilated when you first laid it down?—Yes.

365. Of what diameter is that main?—Four feet.

366. And of what length is it?—Two miles.

367. What fall has the water? What volume can you deliver out of it into your lower pure water basin?—I can deliver 20,000,000 gallons a day in 24 hours.

368. Have you any filter beds at all in connexion with your lower pumping engines?—We have only one system of filter beds, and they are exclusively situated at Lee Bridge.

369. Your twelve acres of filter beds are situated at Lee Bridge?—Yes.

370. Your service reservoirs for a portion of your supply are situated at Old Ford?—Yes.

371. What area of reservoir have you at Old Ford?—The upper surface is two and a half acres. That is when the reservoirs are full.

372. What is the cube in gallons, or in feet?—I have not the figures by me. The form is very irregular.

373. You have no filter beds at Old Ford?—None whatever.

374. The whole of the filtered water must come from the upper filters?—Yes.

375. Then, when you are supplying filtered water it is essentially one and the same water at the upper and at the lower works?—Yes.

376. Have you any division in your services in the district which you supply so that the lower water and the upper water are received separately?—None, except by the force of a self-acting arrangement. The water being pumped into a general district the ends will meet somewhere; there is no division intended.

377. Could you supply the whole of the area through which you give water, from any set of engines, or any engine?—Not properly. It is necessary for the two sets to be working together to supply the district properly.

378. Why?—Because I have not power enough at the upper one to do it to the full elevation, and I have not power enough to do it at the lower one within the 14 hours a day.

379. Supposing that you are not supplying a gallon from your mains, but that you have to pump the water in until it ramifies and fills them as far as it will do so, would any single engine of yours fill the whole of your mains?—I have no doubt that several of them would fill the mains, supposing them to be all shut.

380. Have you any means of supplying your mains by any of your engines separate and distinct from any other engines?—We have no such means or method ordinarily in use. We are well provided with sluices for dividing the mains if necessary, but with the exception of our having two portions at a higher elevation than the others, the mains join each other promiscuously.

381. What engine, or what water supplies those two small elevated districts?—One is at the north end of the parish of Hackney comprising Upper Clapton and Stamford Hill, and I have another in Essex lying beyond Epping Forest. The Stamford Hill district I am able to supply either from Lee Bridge or from Old Ford. The Essex district is exclusively supplied from Old Ford.

382. Then both those high districts are supplied from your lowest pure water basin?—The Lee Bridge water-wheel is now working to Stamford Hill, but for some years past I was entirely supplying Stamford Hill from Old Ford.

383. If water went into your services from the open tanks during the beginning of the year, or before cholera broke out, would it go to the higher districts or to the lower districts?—There is no choice; it would be free to go any way.

384. Is there anything in your mode of supply, so far as you know, which would give a separate water to any separate district?—As to those higher districts, nothing whatever, but as to the lower district a very considerable influence is effected in the following way: For some years past the engines at Lee Bridge, the upper station, have done all the night work. Varying with the season and the condition of the engine, we start the engines at Old Ford earlier or later, but seldom start them later than half-past 5 in the morning, and seldom stop them earlier than 7 or half-past 7 in the evening, and from half-past 7 in the evening till half-past 5 in the morning the supply is entirely produced from the Lee Bridge station, and therefore there is a very considerable difference, taking the way in which your question stood.

385. You are aware that cholera, from whatever cause it comes, did not prevail equally throughout the district which you supplied, but was more intense in some parts than in others?—Yes.

386. So far as your knowledge goes of your own mains and works, was there anything in your mode of water supply to account for that?—Nothing whatever.

387. Was it really the same water, so far as you know, where the cholera was worse and where it did not rage so badly?—Certainly.

388. Was the mode of domestic supply at all different?—Not at all.

389. If the water had anything to do with producing cholera, as far as you are acquainted, the water was the same all through your area?—Yes.

390. (*Professor Way.*) Are you sure that all the water is the same?—Yes.

391. And that it is merely passed from one reservoir into the other?—The lower reservoir is a little further off than the upper one.

392. But the water of it has all gone through the upper one?—Yes.

393. (*Mr. Harrison.*) After filtering the water, you do not let the water come from the upper reservoir at all, except that it goes to the engine and to the pipes?—Yes.

394. Is the water which you pump from the lower station entirely excluded from the light?—The reservoirs are covered over.

395. At Old Ford as well as at Lee Bridge?—Yes, but there is a very small amount of reservoir at Lee Bridge. The Lee Bridge engine may be said to draw almost directly from the filter beds.

396. When you pump from Lee Bridge, in which direction does the main go?—To the west and south-west.

397. When you pump from Old Ford, in which direction does the main go?—The majority of it goes west because the position of the district is west.

398. Would not the water pumped from Lee Bridge and the water pumped from Old Ford have to pass through a considerable length of pipe before they they would meet?—Yes, in any bulk.

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399. Therefore, would not the answer to Mr. Rawlinson's question be that a considerable district must be supplied from the lower reservoir, and another considerable district from the upper one?—It is quite probable that it is so.

400. It is almost certain?—Yes, it is a practical difficulty at certain periods of the day.

401. Was the district where the cholera raged supplied distinctly either from one or other of those two sources?—Yes.

402. From which source was the water supplied to the district where the cholera raged?—Probably from the lower one.

403. (*Chairman.*) Then, if at any time the water was drawn from the open reservoir and the conduit which we have spoken of, it would be supplied to the lower district?—Yes.

404. Then the lower district would feel the effect of it if there was any effect?—Yes.

405. (*Mr. Harrison.*) Do you supply West Ham with water?—Yes.

406. From which source do you supply West Ham?—From the lower source during the day, and the upper source during the night.

407. Did cholera rage much in West Ham?—It was bad there.

408. West Ham is thoroughly sewered, is it not?—Yes.

409. A complete system is carried out?—Yes.

410. And the sewage is taken rapidly away from the whole area?—It flows into Bow creek.

411. Do you know whether in the lower area which you supply there are any private pumps from which water is taken for domestic use?—There are.

412. Are they numerous?—No, I should not call them numerous; they are decreasing.

413. Are they both in West Ham and at the opposite side of the river?—Yes, there are some in the metropolis. West Ham is not a part of the metropolis, and there are several in West Ham.

414. Have you ever had the water from those private supplies analysed?—No.

415. Do you know whether it has been analysed during the cholera?—Yes; it has been analysed from time to time.

416. Lately?—That I do not know.

417. (*Professor Way.*) Have any of those pumps been shut up by authority during the last few months?—I believe several of them.

418. Does Dr. Letheby furnish an analysis of your water every month?—Yes, for our private knowledge and information and justification. (*The witness subsequently furnished an analysis for the years* 1865 *and* 1866, *and it will be found printed at the end of his evidence, Appendix No.* 4.)

419. Does he accompany that analysis with any written report?—A short letter.

420. Stating what the quality of the water is, so far as chemical analysis shows it at that time?—Yes, he gives a distinct analysis of the constituent elements of the contents, but that is not furnished by Dr. Frankland.

421. Does he give with it any comparison of other water supplies in the metropolis?—Not when he sends the report to us.

422. But you have the means of comparison?—We have, but he now reports to an association of medical officers, in which they are all arranged side by side.

423. Within the last few months, that is to say, during the prevalence of cholera in that district, did he make any special report or any special recommendation?—No special recommendation.

424. Was his attention as medical officer and as analyst called in any particular way by your board to the condition of the water?—He analysed some samples for us during the prevalence of cholera, which otherwise would not have been sent to him.

425. With the view of ascertaining whether there was any real ground of complaint of the nature of the water?—Yes

426. What was his report upon that subject?—The water turned out very good upon the analysis. It gave the ordinary result.

427. That was a special report separately from his ordinary monthly report?—Yes.

428. Did he make any remarks in that report?—I think not. I do not recollect any, except that the remark was that the water was a very good water, or some such remark as that, that there was no difference in the analysis.

429. Can you let us have a copy of that report with the other analysis which have been promised to us?—Yes. (*The analysis was subsequently furnished by the witness, and will be found printed at the end of his evidence, Appendix No.* 5.)

430. Do you know whether Dr. Letheby has ever analysed the water before passing through your filters?—Yes, I think that I once sent him a specimen of unfiltered water, but there was a great deal of sedimentary matter after a flood, and I wanted to know what the sediment consisted of, because in conversation with some chemists it had been stated that the quantity of matter in suspension was organic, which was not my opinion. My idea was that it was clay, and I had an analysis specially made to see whether it was so, and it turned out to be so.

431. Do you know at all of your own knowledge whether any change is effected in the chemical composition of the water by filtration. Do you consider that your water is not only cleared from sedimentary matter by filtration, but that it is improved so far as organic matter is concerned?—We conclude that it is.

432. Therefore if the water was bright, and did not require filtration to remove the suspended matter, it would still be improved by filtration?—I think so. I should recommend water being filtrated in either case, unless I knew by special analysis that it contained nothing objectionable.

433. If the powers sought by your Bill for obtaining water from the Thames were given to you, would the additional supply be inferior or superior in quality to your present supply?—I do not think that there would be much difference, the waters are very much alike.

434. With regard to the pollution of the water by the districts lying above your sources, I suppose that it is the intention of your company to put a stop to it?—We are particularly desirous that some system should be commenced under the advice of this Commission, or in any other way in which it could be brought about, by which a diminution should be effected of the free liberty which people have to put anything and everything into the river.

435. The pollution by sewage would be one source of pollution, but I suppose that your attention has been called to other causes of pollution?—We do not know of other pollution on the Lee besides domestic sewage. The manufactories on the Lee are not numerous, or the mills for grinding anything except flour.

436. Are there any paper mills on the Lee?—I think not. Corn and oil may be put down as occupying all the mill power on the Lee to which the Lee water is applicable as a source of power.

437. (*Chairman.*) Do you know whether your filtering area is in greater or less proportion than that of the other metropolitan water companies?—It was in greater proportion, but alterations have been made in the area of the filter beds, which have not been strictly rendered up. I, however, believe that I am now not behind anyone in the area for filtering purposes.

438. Have you at any time recently put in animal charcoal or carbide of iron, or any other matter to oxidize your water?—Nothing at all, but simply fine sand filtration.

439. Have you ever tried such a thing experimentally?—No.

440. Have you ever had it recommended to you?—Yes, by Dr. Frankland.

441. Have you ever seriously thought about it?—I have certainly seriously considered the matter, as to whether it was practicable, or feasible, or manageable.

442. Would not Dr. Frankland be a great authority upon that question?—Yes, as to the chemical view.

443. Have you turned over in your mind the question of future purification, as to what mode could be adopted to purify the waters of the Lee from the sewage of those towns which now pollute it?—The only idea which I have in my own mind runs to the prohibition exclusively of the incoming of deleterious matters, and not to any difference in the mode of cleansing the water after they have got in.

444. The Lee is, I think, a navigable river?—It is in parts. There is a navigation extending from the river Thames to Hertford, and branching out of that to Stortford.

445. As to the mode of purification. If you are to prohibit the sewage from passing in, what is to take place then? Would you have a parallel conduit, and land it into the great outfall of the metropolitan sewers?—That is one way of diverting it. But is it impossible that in certain cases it could be applied upon land?

446. Certainly not. You mean that you would have a prohibition similar to that which was put into the Thames Conservancy Act of last session?—That appears to be the most recommendable plan.

447. Have you looked over the clauses in that Act?—I have carefully read the Act.

448. What do you think of the protective clauses in that Act?—I think that it is quite a step in the right direction. Looking at the interests of water drinkers and water users, I think that they are entitled throughout the kingdom to have protection secured.

449. You see that by that Act the companies have to pay a certain rate or rental to the Conservators for the work done?—Yes.

450. 1,000*l.* a year each?—Yes.

451. Do you think that your company would object to pay a contribution for the necessary work?—I am quite sure that they would not object to pay a contribution—of course I cannot say anything as to amount.

452. It must be equitable and reasonable?—Yes.

453. What body do you think would be competent to carry out the necessary prohibition—would it be yourselves or the River Lee Trustees as a company, or would it be a new body to be set up?—I think that you would have to establish a new body.

454. Do you think that the Trustees would not take that if they were held free from cost?—The Trustees of the Navigation at present are an unpaid body of gentlemen belonging to the neighbourhood of the Lee. They might undertake onerous duties, and duties which would be much more invidious than anything which they have had hitherto to undertake in the exercise of their duties as a trust.

455. Are you aware whether the Conservators of the Thames are an unpaid body or a paid body?—I thought that they were paid.

456. I believe that there is an allowance made to them?—(*Mr. Beardmore.*) The River Lee Trustees have no payment.

457. (*To Mr. Greaves.*) They pay their officers?—No doubt.

458. Then the Conservancy of the river Lee would come under the cognizance of their officers?—Yes. But I think that if the duty in question was confided to a trust, the representatives of all those interested should be able to put in their own appearances. I do not think that you could altogether delegate it to a trust; you might delegate it to a body of paid officers.

459. Are the members of the trust not elected?—I am not aware of that.

460. (*To Mr. Beardmore.*) Are they nominated in and in amongst themselves or are they elected?—Some are elected, but there are a good many *ex officio* Trustees, the members for the counties and the New River Company are representatives *ex officio*.

461. I suppose that the trust is framed something like the old Conservancy of the river Thames?—The New River Company are represented officially by the Governor, and the Deputy-Governor, and the Treasurer.

462. (*To Mr. Greaves.*) So far as you have considered the question, you think that the duty must be performed by a special body?—I think so; the question is a wide one, and will require a good deal of consideration. You are aware that the jurisdiction of the Metropolitan Board of Works ends of course in the metropolis, and the metropolis is bounded by the river Lee. The jurisdiction of the Essex Commissioners of sewers comes up to the borders of the Metropolitan Commissioners, they therefore have an interest in that portion of the valley of the Lee, as far up as their district runs, down to the Thames. Then there are several suburban parishes, where sewage is becoming a great annoyance and a detriment to the district, which are beyond the limits of the district of the Metropolitan Board, and are beyond the limits of the district of the Essex Board, and they would not exactly be at one with us, because their ground reaches down to the point where we take clean water. It therefore seems to me that there are many interests to be represented beyond those of the mere water drinkers, whose interests would be well confided to some general body or commission, to whom all these interests should be confided.

463. But as in this country taxation and representation are considered to go together, do you think that your company, if they are to be rated at all, should not also be represented?—I am strongly of opinion that they should be very distinctly represented.

464. Have not you a larger interest in preventing pollution than any other individual, as your success depends upon your giving water which shall not be open to the charge of producing disease?—Certainly.

465. (*Mr. Harrison.*) What is the character of the subsoil of the district which you supply with water?—Mostly gravel.

466. Are there cesspits or anything of that sort to any extent remaining in the district, or is it thoroughly sewered, and is the sewage carried away by a regular sewage system?—There are still a great number of cesspits.

467. Are any of those in juxtaposition to the wells which you have mentioned?—They were. I cannot from my own knowledge say that they are at present, but it is almost impossible that it should be otherwise.

468. If there are these cesspits, and if the subsoil is gravel, and if you have these private wells, there is a probability of an intercommunication?—Certainly.

469. I presume that you are well acquainted with the general area of the river Lee?—Pretty well with the whole district.

470. Besides your company, the New River Company take their water from the river Lee, do they not?—Yes; principally from the river Lee, and if not from the river Lee, from springs issuing in the district close adjoining it.

471. Then there are three bodies which are interested in the water of the Lee, the New River Company, the Trustees of the River Lee for the Navigation, and you, the East London Waterworks Company?—Yes; there are those three bodies who are interested in the water.

472. How far do you say that the navigation goes?—The main line goes up to Hertford, and there is a branch from that to Stortford.

473. From what point do the New River Company take their water?—At a place called Balance-Engine, between Ware and Hertford.

474. Is the town of Hertford above the point from which they take their water from the Lee?—Yes.

475. Have they any intercepting system similar to yours, so as to carry the sewage of Hertford below the point from which they take the water?—Yes, they have an intercepting system, and drains are laid

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into it from Hertford, by which the water coming down, after having been treated by a special process, is carried forward into the river.

476. What towns are there above Hertford situated upon the base of the area from which the New River Company draw their water?—The principal town is Luton.

477. Is that a very large town?—It is the largest town in the whole watershed of the Lee.

478. Do you know the number of inhabitants of Luton?—17,000 by the last census.

479. Are you pretty well acquainted with the geology of the basin of the Lee?—Yes.

480. What is the geological character of the district from which the New River Company obtain their supply?—I should say that certainly chalk predominates as the subsoil, and may be considered to be the main geological stratum of the district, it is overlaid with patches of one thing and another, but in no great quantity.

481. Can you give us the total area of the water basin of the Lee?—The total area of the water basin of the Lee may be called 500 square miles.

482. Can you give us the area of that part of it above the point from which the New River Company take their water?—On my papers it stands as 244 miles.

483. That is about one half?—That is about one half of the whole watershed.

484. There is the Lee Proper, from Luton down to Hertford, does it chiefly flow over the chalk formation?—It chiefly issues from the chalk formation.

485. Does it chiefly flow over the chalk formations?—I do not think that chalk appears very extensively as a surface in the valley, but I believe that it is not far below.

486. The Mimram is a tributary coming in above Hertford, is that principally through the chalk?—There is chalk to be found at no great depth, and there are chalk cuttings.

487. Would you call it a chalk district?—Decidedly.

488. Then there is the Beane, is it a chalk district?—Yes.

489. Do they obtain their water from the Rib?—Yes, those three rivers and the Rib or Quin unite.

490. Is it chalk?—Yes.

491. Then there is the river Lee running northward by Hatfield?

(*Mr. Beardmore.*) That is the Lee Proper.

492. Is that upon the chalk?—Yes, but a large tributary shown on the clay does not exist; the ordnance map should be corrected.

493. What is the volume of water which the New River Company have power to supply?—The New River Company have power to draw from the river at that point, 2,500 cubic feet per minute.

494. How many gallons a day would that be?—22,500,000.

495. What volume of water is required for the navigation, is any certain quantity reserved for that?—Those quantities are strictly defined; there are three quantities, an upper quantity, a middle quantity, and a lower quantity, and they can be stated.

496. Those two volumes of water are the first claim upon the river at the upper part?—The New River draft is the first draft, but that is subject to the quantity required for the navigation. Then the quantity of water used for the navigation is not altogether abstracted from the river, because the navigation goes in and out again, here and there using the natural course of the river, and then passing from it in short cuts which re-unite with the river.

497. Have you any information as to the volume of water which passes Hertford from all those sources in a very dry season, such as 1864 and 1865?—I have no precise information.

498. You have not gauged the river?—No measurement of the river has been made there.

499. Besides those rivers which supply the Lee at Hertford, is there the Ash?—That is the next stream.

500. Is that in chalk formation?—Yes.

501. Throughout its whole course?—I think so. I have never been all round the borders of it, but wherever there are any deep cuttings made or any excavations about the Ash they show chalk.

502. Is it the same with the Stort?—The Stort is chalk in the upper portions of it, but there is a large extent of clay in the Stort Valley.

503. Those are the two principal tributaries from which you derive your supply, independently of what may be left after the New River Company and the navigation have abstracted the quantities which they have the power to abstract?—Yes.

504. What volume of water does the Stort afford in a very dry season like 1864 and 1865?—I do not know that any precise measurement has been taken or can be taken of the water issuing from these rivers as distinct from one another, it would be a difficult and intricate process, and in order to be worth anything it must be maintained through a long series of observations.

505. Is it or not the case that the Stort in a very dry season is reduced to a very low ebb?—I have no doubt that it is.

506. From the character of the soil do you not think that it would be so?—Yes, and no doubt it is so.

507. The rivers above would be more of a perennial character, and the Stort would be much more of an intermittent character?—Yes.

508. So that in a dry season the Stort is not to be relied upon for a water supply?—No, you cannot rely upon it for a delivery of water as you can on the others. The Ash also runs very small in dry weather though it is very much in chalk.

509. Then in dry weather that would reduce your source of supply chiefly to the leavings of the navigation and of the New River Company above?—No, I can hardly say that, I think that it is quite possible that there may be as much other water; that is a point which I have hardly come upon.

510. If the Ash and the Stort are your chief sources of supply besides that above, and if those streams, as you state, are reduced to a very low ebb in a dry summer, it seems to me you are left with the leavings of the New River Company and of the navigation above?—Yes.

511. Although those streams are of large area they really do not afford you much water in a dry summer?—No; but there are very considerable springs below the point at which the New River Company takes its water out of the river.

512. In the years 1864 and 1865 what was the fact as to the volume of water which came down to afford you a supply?—It was barely enough in 1864.

513. What volume of water was then coming down the river at the point from which you take your supply?—20,000,000 gallons a day, I suppose, or more.

514. Between the point from which you take your supply and Hertford, is there not a very considerable population?—There is.

515. Even above the point from which you divert the sewage past your works?—Yes.

516. Is that a population lying comparatively near the river?—Some of it lies very near the river, and some of it lies at a distance. I do not know whether that would characterize the whole population, but a good deal is near the river.

517. Is that population to a very great extent situated upon the London clay?—No, I suppose that you would hardly locate the population of Waltham upon the London clay, although a part of it is upon the clay. The population of Waltham Abbey and Ware are entirely in the flat part of the valley with clay and gravel and some chalk, and the population of Stortford is on clay resting upon chalk.

518. Any liquid falling upon the surface is not likely to get through the London clay on to the chalk?—Not through the amount of clay which there is there.

519. Is there any system of sewerage carried out throughout that district?—No general system; each town is left to its own affairs.

520. Have they carried out any system of sewerage?—There are drains more or less.

521. Where do they discharge?—Into various parts of the river; none discharge into anything else but the river.

522. Can you give us the population between the point where you take the water and Hertford, including Hertford and Ware?—I think that I have notes of the population of different places. The population of the parish of Waltham Abbey, which is a very extensive parish, and the majority of it on the eastern side of the Lee with some on the west stands in the last census as 5,044. The population of Ware which is next above is 5,397. The population of Hertford is 7,086.

523. Are there not some towns or considerable places intermediate between Waltham Abbey and Ware?—There is Cheshunt which is a populous place, it stands in the census as 6,592. The population of Hoddesdon stands as only 1,898.

524. Is there any considerable population on the Stort?—There is Sawbridgeworth on the Stort with a population of 2,701, that is taking the whole parish. I have not the towns or the populous places. Stortford is the most important place on the Stort with a population of 5,390.

525. Besides those places there is a consideral rural population?—Yes, and a considerable population of small hamlets and villages, but those are the principal accumulations of people. I have taken out figures from the population tables, but I have had no means of separating between the more townlike sets of inhabitants and the pure rural districts.

526. The sewage of all these places you say comes into the Lee and its tributaries above the point at which you take your water supply?—Yes.

527. And the water of the Lee is diminished by that abstraction; the Stort and the Ash are reduced in the summer to a very low ebb as to supply?—Yes.

528. Does it not follow that with that small quantity of water coming down to you, and with a large population resident upon the banks, in such a summer as those of 1864 and 1865, the water at the point at which you take your supply must be very much polluted?—It does not follow so clearly as to put it in that simple form, because during the time when the river is low the discharge by all these towns and villages is low; I do not know that the pollution is very much worse then than it is at other times; there is no doubt that the pollution militates against the prospect of having pure water.

529. For how many days supply did you say you had the means of storing water?—For seven or eight days, and still having something left.

540. So that in a dry summer such as those of 1864 and 1865 you are practically dependent entirely upon the river itself as it comes down to you?—Yes.

531. And you cannot take advantage of any considerable flood, so as to store a large quantity of water after the river has been cleared out and the water comes down comparatively pure?—No reservoirs have been yet made with a view to store over such a length of time as you would imply; there are none to store winter water for summer time; it is possible that they might be made to a limited extent so as to supplement the flow very considerably.

532. Have you gone into the question of the Acts of Parliament which have been passed at different times bearing upon this inquiry?—I believe that I am acquainted with all the Acts of Parliament.

The witness delivered in the following paper:

Paper delivered in by Mr. Charles Greaves, the engineer of the East London Waterworks Company.

1. The river Lee rises in Bedfordshire, flows by Luton and Hertford, then takes its course by Ware, Hoddesdon, Broxbourne, Enfield, Tottenham, and Hackney, to its confluence with the Thames.

2. Its principal tributaries are,
The Upper Lee at Hatfield;
The Mimram above Hertford;
The Beane and the Rib immediately below Hertford;
The Ash below Ware;
The Stort at Hoddesdon (including the Pincey Brook);
The Cobbin Brook at Waltham Abbey;
The Chingford Brook at Edmonton.

3. Of these several streams none but the Lee and Stort is subject to any special statutory regulation.

The following are the Acts relating to the Lee:

1.—13 Elizabeth cap. 18. An Act passed at the instance of the Corporation of London authorizing them, with the aid of Commissioners named in it, to take lands for making and to make a navigable cut from the Lee at Ware to or nearly to the Thames.

2.—Jac. 1. By which Act the New River obtained their original power to take water from the Lee.

3.—12 Geo. 2. cap. 32. An Act to extend the Lee navigation, as effected by the Corporation of London, under the Act of Elizabeth from Ware to Hertford, to ascertain and settle the quantity of water which the New River Company might take from the river and the mode of taking it, to appoint Trustees to carry the Act into execution and watch the New River Company's works and draught, and to make the New River Company liable to pay certain annual sums (300*l.* and 50*l.*) to the Trustees for the support of the navigation between Hertford and the Corporation cut.

4.—7 Geo. 3. cap. 51. (1763.) An Act for authorizing various improvements of the navigation by new cuts and otherwise for extending it to the floodgates at Hertford, and for vesting the entire jurisdiction theretofore exerciseable by the Corporation of London and by the Trustees appointed under the Act of Geo. 2., with various new powers for improving and managing the river for the purposes of navigation in a new body of Trustees, being in substance the same body of Trustees as now constitute "the River Lee Trustees." This Act also gave the Trustees the first power of taking tolls for the use of the navigation and to borrow monies on the security thereof.

5.—19 Geo. 3. cap. 58. (1779.) This Act for increasing the tolls on the navigation, for conferring some further powers on the Trustees, and ratifying certain arrangements between them and some of the millowners.

6.—45 Geo. 3. cap. 69. (1805.) This Act was principally for confirming arrangements between the Trustees and some of the millowners.

7.—47 Geo. 3. cap. 72. (1807.) This Act incorporated the East London Waterworks Company for supplying a large area in the east of London with water, and authorizing them to take the waters of the Lee for the purpose "at or near Old Ford," but only "during such time as "the tide water should be flowing up the river, and had "flowed to such a height as to stop the working of the "mills below on the river."

8.—48 Geo. 3. cap. 8. (1808.) This Act sanctioned the absorption by the East London Company of the previously existing Shadwell and West Ham Waterworks, which had certain statutory rights of taking water from the Lee below Old Ford: but the whole matter is entirely obsolete.

9.—10 Geo. 4. cap. 117. (1829.) This Act first authorized the East London Company to take water above the influence of the tide, viz., between Lee Bridge Mills and Old Ford Lock, and for this purpose to make an aqueduct of limited size from the tail stream of Lee Bridge Mills to Old Ford. This Act in protection of the navigation restricts the company from taking their water higher or elsewhere, but seems to have left them at liberty still to take the tidal water, at all events it contains no clear repeal of the power to do so. The navigation and mill and riparian interests were propitiated in respect of this higher taking of the water by an annual payment of 250*l.*, secured by the Act to the Trustees, by the company becoming bound to construct and maintain "compensation" reservoir at Hackney, and by divers special enactments for the protection of the navigation and other interests.

10.—13 & 14 Vict. chap. 109. (1850.) This important Act (ordinarily called the River Lee Improvement Act 1850) effected many objects. It improved somewhat the construction of the trust and incorporated the trustees. It authorized several new cuts and other navigation works. The Trustees took on themselves some works with reference to the East London Company's supply, and that company came under obligation to make considerably increased annual payments to the Trustees, and the

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quantities of water they were to take and the manner of taking it were regulated. Several special arrangements were sanctioned between the Trustees and the East London Water Company, and other (mill and riparian) interests, and the Trustees acquired the power of selling for the purpose of supply to certain specified districts the surplus waters of the Lee, so nevertheless that proper reserve for navigation purposes should be made. As regards millrights, the river was to be gauged and the amount of the river's water power throughout ascertained by engineers, and compensation given to each mill, &c., for any loss by reason of any act of the Trustees.*

(This Act is full of important details.)

11.—15 Vict. cap. 164. (1852.) By this Act all the previous Acts of the East London Waterworks Company were repealed, but several scheduled provisions contained in them (as to the compensation reservoirs and the like), and all the provisions relating to the company to Trustees; the Acts and the New River Company's Acts were saved and the company was re-constituted, its capital and powers and district defined afresh, but without alteration (except as next mentioned) of their point of supply from the Lee; and as regards general regulation it was brought under the Waterworks Clauses Act, 1847. The company acquired powers to make reservoirs and filtering beds at Lee Bridge, and new cuts upwards from thence to Tottenham mill tail and mill head so as to separate their water from the general stream and the navigation at a higher point. They also acquired powers to make and maintain an intercepting drain so as to intercept sewage and foul waters then reaching the Lee at divers points on its right bank above the company's supply head, and to take them lower down and pass them into the river (navigation) below the company's supply head.

12.—16 & 17 Vict. cap. 166. By this Act (which is now the governing Act of the East London Waterworks Company) the company's Act of 1852 was repealed, but all its provisions material to the present consideration were re-enacted, the company's district was somewhat extended, further reservoirs were authorized, and some few further provisions as regards outside interest inserted; but a main object of the company in coming before Parliament in 1853, that of raising their supply head to a much higher point on the river, failed.†

The unsuccessful parts of the company's application to Parliament in 1853, although at first sight not directly material to the present inquiry, ought not to be passed by, for the same difficulty in 1866 exists, and renders the nonpollution of the stream more important.

The company in 1852 were required by Parliament to seek in 1853 powers to take water from a higher point on the Lee, and accordingly they prepared plans, &c., and sought by their Bill of 1853 powers to make new cuts from the neighbourbood of Lee Bridge to a point on the river immediately below the confluence of the Lee and Stort. This proposal was opposed by the Government as owners of the powder mills and armoury works at Enfield, and was necessarily abandoned, and the legislation of 1853 ended therefore without affecting materially that of 1852.

In the same year and as part of the same plan, the company proposed a scheme for intercepting the drainage of Hertford, but this fell (as not worth pursuing) when the higher supply head was denied them, and it was besides understood that the New River Company would undertake it as immediately affecting their main supply.

13.—17 Vict. cap. ., 20 Vict. cap. . (1854 & 1857.) By these Acts the New River Company undertook the making of a system of drains for Hertford, and obtained provisions for preventing sewerage being discharged into the Lee.

14.—18 & 19 Vict. cap. 196. (1855.) By this Act there was vrey important legislation respecting the Lee, it was obtained at the joint instance of the River Lee Trustees, the New River Company, and the East London Company, and its main objects were to settle differences octween the Trustees and the New River Company, and to define more conveniently the relations of the Trustees with each of the companies and the rights of the companies *inter se*. The general effect of the Act is, after making due reservation to the Trustees of water in the upper parts of the river for the purposes of the navigation, and of all its water below Old Ford Lock, to transfer all the water of the river to the two water companies on the New River Company paying a sum in gross and the two company's jointly paying a perpetual annuity of 3,500*l*. to the Trustees. The Act limits the draught of the New River Company from the river at Hertford, and that of the East London Company at their lower point, and subject to the above-mentioned reservations and their own draughts and their respective limitations, the two companies are by this Act placed at liberty to take the entire river *pari passu*.

15.—29 & 30 Vict. c. 89. (1866.) This "The Thames Navigation Act, 1866," contains provisions extending (not by name) to parts of the Lee, viz., those provisions relating to "pollution of water," (63 and following sections,) and which reach those parts of the Lee situate within three miles of the Thames measured as in that Act mentioned.

The following are the Acts affecting the Stort.

32 Geo. 2. (1729), 6 Geo. 3. cap. 78. (1766.) By these Acts (the latter seems to repeal the former), certain "undertakers" were authorized to execute works and maintain jurisdiction over the river Stort between the town of Bishop's Stortford and the confluence with the river Lee.

As matter analogous to direct statutory jurisdiction affecting the Lee, there is also the jurisdiction of the Commissioners of Sewers for the levels of Havering in Essex and Middlesex.

533. You have handed in a list of the Acts of Parliament; may we take that as being correct, and as giving all the necessary information?—Yes, as giving all the facts belonging to the statutory position of the company.

534. Is there any special points in any of those Acts to which you wish to call our attention?—I am not aware there is anything in which I could assist you by describing it. The East London Act of 1853, is the principal Act upon which we rely for all our domestic arrangements and management, and the the Act of 1855 is the Act on which we rely for the arrangements as to taking water from the river, between ourselves and the New River Company and the River Lee Trustees.

535. I think you mentioned that the river Lee floods the adjoining lands to a considerable extent?—Yes, very largely.

536. How far does that extend up the river?—Throughout more or less.

537. Is the valley much flooded above Hertford?—Certainly not to the extent it is below.

538. By the tributaries above Hertford?—There are floods considerably above Hertford, but not very bad; the heaviest flooding begins below the junction of the sixth tributary, that is to say, below the junction of the Stort.

539. After the river has got upon the London clay?—Yes.

540. Do the two rivers, the Ash and the Short, pass down in flood time a very considerable volume of water?—The Stort sends down a large quantity of water very quickly in floods. I do not know much about the Ash in flood time; it is a river which one does not often visit.

541. Is that more strikingly the case with those rivers, than with the Lee Proper above Hertford, and the Mimram, the Beane, and the Rib?—So far as my knowledge goes, I think so; I cannot speak with precision as to that point; I do not think that the tributaries flood very much.

542. Have any steps been taken to prevent the flooding of the lower part of the Lee, by embanking or other means?—None at all, there is no system of embanking in the Lee anywhere.

543. To whom does the bed of the river proper belong?—To various owners; there is no jurisdiction; there is no statutory power governing the channel, or the bed of the river as an old river apart from where it may be used for navigation. The riparian proprietors have never joined together, nor is anybody charged with any duties with respect to it; in fact the majority of the flat lands on the Lee are common lands or lammas land, that is to say, common for six months in the year; each parish has a large extent of meadow lands of that kind, but in some of the

* These gaugings were made and recorded and are now in operation.

† In this year (1852) also there was passed the Metropolis Water Act, 1852, which *inter alia* interdicted the companies from the supplying of water not previously filtered and gave the Board of Trade jurisdiction to inquire (on the memorial of consumers) as to the quantity and quality of water supplied.

parishes the Enclosure Act has been taken advantage of, and these flat lands have been appropriated to individuals.

544. Is the flooding advantageous or otherwise to those meadows in an agricultural point of view?—That is a question which I cannot answer, and I do not know how it could be answered; there are no data to institute a comparison.

545. Do you know whether the flooding affects the health of the people adjoining?—I have no doubt that there is a greater amount of ague and ailment arising than there otherwise would be from cold and damp air, in consequence of the extent of flooding in the low land.

546. Do you know as a fact that there is ague?—It is not a fact that ague is rampant, but rheumatic fever is a very common ailment with working people all through the valley of the Lee, which I think shows that the damp air does affect their health.

547. It was mentioned in the evidence before the commission a fortnight ago, that some improvements made many years ago below Skipton upon the river Aire had had the effect of removing ague, and that some further improvments which had been made within the last few years had had the second beneficial effect of removing fever, which had been very rife before?—I am glad to hear it.

548. (*Chairman.*) A storage of 20,000,000 gallons a day for seven days would give a reservoir area of 140,000,000 gallons; do you think that you have anything like that amount of reservoir space at your command now?—I think that the amount is 170,000,000 gallons, and I am not quite sure whether it is not a little more.

549. In the spring of this year, when the old reservoirs happened to be connected with your pumping machinery, were you at home or not?—I think not; I will not say precisely.

550. You admit that there was a period when the supply was pumped in from the open reservoir?—A quantity of water was let in.

551. In the spring of this year?—Yes.

552. But you do not know the date?—No.

553. And you do not know whether you were at home or not?—I do not think that I was; I will not say.

554. Do you think that it is worth while clearing up that point?—I do not know that any new fact would come out of it.

555. There would be this fact, as to whether or not a large volume was pumped in, and as to the time when it was pumped in, and under what conditions it was pumped in, and why it was pumped in?—It would not alter that condition of things.

556. What necessity existed for pumping that water into the mains?—Only as I described before, that the water on the covered side may have been rather lower than they liked it to appear, and that therefore they replenished it from the other.

557. Had it been customary in former years to subsidise from that source?—We had a little in the year 1864.

558. And no evil results that you are aware of arose from it in 1864?—No.

559. There was no cholera?—There was no cholera.

560. Will you think over the question of any practical form of Conservancy by which the purification of the waters of the Lee and its tributaries may be brought about?—I will do so; that is, assuming that a prohibitory power is a possible enactment.

561. Take the River Thames Act, which you have before you, as a basis, or as a thing accomplished; Parliament has there enacted certain regulations which are to be put in force by a certain machinery?—Yes.

562. If you would quietly look over that Act, and seeing that your company is so vitally interested in the question, if you would give it a consideration, we should be very much obliged to you; it might facilitate our making a proper recommendation upon the subject?—I shall be very happy to give it any consideration which I can, but after the better experience which you as Commissioners have on this matter in a general way, we are rather inclined to look to you for correct advice on the matter. It is not an easy thing to determine how a new Conservancy Board can be established without any previously existing basis, and the case of the Lee does not compare precisely with the position of the Thames, as given over to the Conservancy Board, because in that case they have multifarious duties besides keeping clear the upper valley of the Thames.

563. The River Lee Commissioners are commissioners for purposes of navigation?—The trustees of the navigation itself have certain funds for the purposes of the navigation.

564. And so long as it serves the purpose of navigation they have fulfilled their trust?—Yes.

565. And you think that they would hardly be the body to be entrusted with conservancy powers?—I think that the conservancy body should consist of a certain number of members elected from all the different interests.

566. I suppose that primarily you would say that any conservancy, however constituted, should be a conservancy capable of being worked at the least cost necessary for efficiency?—Most decidedly.

567. As your board would be one of the boards served, and very probably one of the bodies rated, you think that the conservancy should not be a very extravagant conservancy?—It should not; there should be no more money spent by it, or upon it, than was necessary to sustain a common course or line of action.

568. Having the wide experience which you have, and being resident upon the ground, do you think that a Conservancy Board may be established which shall be worth its salt?—I think so.

569. Which shall not cost more than the work which it is capable of doing will be worth?—I think so; but unless a board of that kind were in some sense elective, if it only consisted of a number of persons specially charged with a certain duty, they would be a river police, and they would have all the unpleasant side of the matter to face, not for their own interests, but simply in discharge of a duty for which you may suppose that they would have salaries.

570. If a new Conservancy Board is to be established, and if it is to be elected, I presume that all the towns and all the riparian owners would have votes for representatives, and that your company and the New River Company would either nominate or have elective powers, and that some Government office, such as the Board of Trade or some other public office, might have an elective power and a supervision in case of appeal, similar to the case of the Thames Conservancy?—I think that that seems to be the shape which it appears most reasonable that it should take.

571. (*Professor Way.*) You say that when the river is in flood you endeavour to shut it out from your reservoirs as much as you can?—Yes.

572. Are you always able to do so?—We have excluded every flood which we cared to exclude since we have had the reservoirs, from which we can draw during the prevalence of the flood.

573. Is it not the case that the months of May and June and the whole of the early spring in this year were droughty?—Not this year; the river has been abundant this year.

574. Was not it a dry spring?—We did not find it so in the rivers; these rivers are very abundant in their springs, the sources of them being deep, and being in chalk, they are frequently in very good flow when the weather may be apparently dry. The floods which I speak of are floods of quantity in the river, and not floods of rainfall.

575. Those two things are not necessarily coexistent?—They do not correspond; 1864 is the only year which we can speak of as a droughty year; the year 1865 was very irregular, there were months without much rain, and there were months with a good deal of rain.

576. (*Mr. Harrison.*) Did you find September 1865 the period when the river was lowest?—I do not know; I do not think that I have any paper by me which could recall that to my mind. I believe that in September 1865 the flow was low.

577. Have you kept any rain gauges in this district?—I have rain gauges on my own establishment.

578. Can you give us a return for the last two or three years?—Yes; my rain gauges are kept at Lee Bridge. I can give you returns from there. (*The witness subsequently furnished the return, and it will be found printed at the end of his evidence, as Appendix No.* 6.)

579. Have you any evaporation gauges to show the quantity of evaporation?—I have made some experiments on evaporation, but they are hardly in a condition to report. I should be rather diffident in putting them forward.

580. How many years have you tried it?—More or less imperfectly for seven or eight or ten years. I shall probably make some returns of those experiments some day, when I can get them carried on long enough unbroken to make them fit to be exhibited.

581. Do you know the experiments which Mr. Dickenson has made upon percolation?—Yes.

582. The soil being all chalk, the difference between the rainfall and the percolation would be evaporation?—Yes.

583. Do you find that your experiments at all accord with his observations for a number of years?—I think that my percolation shows rather less than Mr. Dickenson's observations have given.

584. Is your gauge of a similar character?—Yes; the water passing through it is measured, and is registered as percolation.

585. For how many years have you had that gauge?—I think since 1853 or 1854.

586. How frequently has it been observed, once a month?—More frequently than that, it has been according to the quantity; the receptacle for the water cannot be adjusted to contain more than a certain quantity, so that if it gets too full it is emptied and is registered off.

587. Is that up to the present time?—Yes.

588. If you could let us have the result of it, so as to make a comparison, it would be very valuable?—I will furnish you with some abstract.

589. Have you any observations upon evaporation, as well as upon percolation?—I have also endeavoured to make some observations upon evaporation from the surface of the water, as compared with evaporation from the surface of the ground, but they have not been carried on so long. (*See Appendix No.* 6 *at end of this witness's evidence.*)

590. What result have you come to as to evaporation from the surface of the water in this neighbourhood?—In 1864 we had an evaporation of seven inches straight away upon the surface of the water, which very much surprised me.

591. Within what period was that?—Three months; and it reached 9·371 inches in five months.

592. It varies at different times?—Yes, it is continually varying.

593. What have you found to be the average evaporation per annum from water?—I have not the figures at hand sufficiently precise to quote.

594. (*Chairman.*) Are your experiments so far as you have gone confirmatory of the prevalent notion of evaporation from water, or are they subversive of it?—So far as I have been able to read up the subject of evaporation, as treated of in books, I have found the evaporation to be greater in amount than I have been instructed from books that it is.

595. You have tried to get at the accurate amount of evaporation by a method of your own, which you think puts it in a much fairer way than the ordinary evaporating pans?—Yes; I think that the ordinary evaporating pans are rather delusive, and difficult to manage. I think that you may take it as a frequent result that four-fifths of all the rain which falls is re-evaporated, and that rather more is evaporated from the surface of the water than is evaporated from the surface of the ground.

596. (*Mr. Harrison.*) What would you say is the average rainfall in this neighbourhood?—25 inches.

597. Then four-fifths would be about 20 inches?—Yes.

598. (*Chairman.*) But the evaporation from an evaporating pan gives you more than the entire rainfall?—Evaporating pans acquire accumulated heat, and they evaporate more than they ought to do.

599. If you expose water to the continuing action of the atmosphere, the effect is something above the fall of rain?—That is not the result of my gauge.

600. The Birmingham Philosophical Transactions give it as such for Birmingham, if I recollect rightly?—I have no faith in evaporating dishes in ordinary cases.

601. I should say not; but if you could know what a reservoir of 10 or 12 feet evaporated, it would give a reliable test?—Yes, if you could cut out a portion of the surface.

602. (*Mr. Harrison.*) That would be merely evaporation from the water, and not from the surface of the ground?—Yes.

603. You do not mean to say that four-fifths is the evaporation from the surface of the water?—It would be rather more than that, it would be four-fifths from the surface of the land; you cannot depend upon more than one-fifth to percolate and to form springs.

604. That is only reliable under certain circumstances?—Certainly, and occasionally.

605. You cannot apply that rule to the west of England, the rainfall being considerably larger and the evaporation smaller?—Certainly not, and perhaps the rainfall occurs at a different period of the year.

606. There are cases of that kind which make it necessary to examine each locality; you could not apply the experiments made in London to any other district in England?—No, it would be scarcely fair to do so.

607. (*Chairman.*) Do you remember about the period of the floods this year, had you any floods early in the year, in January and February?—I cannot call that to mind, I have not directed my attention to that point for this evidence.

608. But this has been a wet year throughout?—Yes, there is no question about that.

609. At no period have you been short of water?—Not at all.

610. (*Mr. Harrison.*) You gave us the area of the basin of the Lee above Hertford and Ware, can you tell us at all the population upon that area independent of Hertford?—I have not taken it out exactly in that form.

611. In what form have you taken it out?—The population of the whole watershed of the Lee, taking it down to and inclusive of the districts which many years ago we diverted, I put down as 174,000, that is down to the border of Hackney, not including Hackney or Walthamstow.

612. Can you give us the population below Hertford, including Hertford, in the same way?—I can give you the population in 1861 of the district diverted in 1852. I have it as 51,900, you may call it 52,000.

613. (*Professor Way.*) I do not think that I made myself understood just now. When you are short of water in the river Lee you are necessarily short of water for your supply, are you not?—Yes, if we had it not in any way the supply would run short.

614. If you had not a considerable store?—Yes.

615. When the river Lee is in flood you object to take it into your reservoirs, because of the matter in suspension, which chokes your filters too much?—Yes.

616. In either case is it not possible that you might run short of water, that is to say, if the flood was continuous for five or six days, and if you had only five or six days' supply in your reservoir, you would be short of water?—But then I should let in the flood; I should not run short when there was an abundance outside.

617. There are times when you would run in flood water?—Yes, rather than go short of water.

618. Has that occurred at any time this year; at any time during this year have you let any water out of the river Lee in time of flood?—You may shut out a flood one day and let it in the next.

619. You do let in the flood water?—Yes.

620. Can you practically always shut out flood water from your reservoirs?—Yes.

621. But if the flood went on for five or six days you would be obliged to take it?—Yes; I have not reservoir enough to shut out such a flood; in fact this way of working the reservoir is more an incidental advantage which has arisen from the character of the work than from any previous design.

622. Is it not the fact that when you let in flood water you have a large quantity of sediment which is injurious to you; have you not the washings of all sorts of different places which the flood would bring down?—I do not think so. I do not think that there is a greater proportion of anything which is bad in the water when the river is in flood than at other times. Speaking for myself, I should prefer a flood to a drought at any time. I think that the water is more prejudicial during periods of drought than during times of flood.

623. (*Mr. Harrison.*) I think that that is rather contrary to what you said just now, when I asked you as to the condition of the water of the Stort, and the Ash, in the summer time?—I said that it was not worse during a drought than in the ordinary condition.

624. Your argument was that there being very little water about, very little dirt was washed into it?—It is not easy to draw precise comparisons upon all these points.

625. I presume that when a flood comes down it brings a great amount of refuse?—According to its degree, according to its duration. Sometimes a flood brings down mud into the river, it is exceedingly desirable to shut it out, that is almost entirely mineral matter.

626. How many days is it before it comes?—I could not put down any precise duration for a flood, it all depends upon the continuance of the rain, and where it comes from.

627. (*Mr. Harrison.*) But generally after a flood commences will the water run thick for a while?—We generally find that upon the third day from the commencement of a flood the great body of deposit in the water is cleared away, the river in fact has cleared itself of a great body of deposit.

628. So that if you had a full supply in your reservoirs before a flood commenced, you might continue to give off water from that supply, and at the end of seven or eight days receive a volume of water from the flooded river which would be comparatively pure?—Yes, that is the precise explanation of the matter which I have described.

629. (*Chairman.*) Although it had more visible mud in it, the water itself would be of a better character?—I do not fully apprehend that question. The water would be improved by its course through the reservoirs.

630. The water would be more diluted, and although there was visible mud in it, it would come into your pure water basin a better water than the dry-weather flow?—I think that it would hardly go to that extent; that is putting it too much the other way again.

631. (*Professor Way.*) I suppose that the different materials from the towns above your water supply would be washed out by the flood?—Yes, and they would come down with the first of the flood, and the first of the flood is very turbid in consequence.

632. Supposing that you had a flood supervening upon a very dry period, you must take in water earlier than you would wish to do?—Yes.

633. That you say has not occurred this year?—No, I cannot discriminate that it has done so; we have had no trouble this year. If the excessively turbid water has passed by we fill up so much the sooner.

634. The turbid water I presume is a guide by what you can see to what you do not see?—It is.

635. (*Chairman.*) Do you know whether any foreign substance, such as charcoal or carbide, or any material of that description, is used in any place upon a great scale for filtering water?—I believe that it is not, from inquiries which I have made, and information which I have gathered.

636. Do you know anything of the supply of water at Wakefield?—Nothing more than that I believe that it is one of the places where Mr. Spencer's process has been tried.

637. And where it is being carried on?—I believe so.

638. Have you made any experiments upon a small scale, for your own satisfaction, either with wood charcoal, bone charcoal, or carbide?—Not recently. I did a little in the way of filtering dirty water through vegetable charcoal some years since.

639. Do you know what is the chemical or mechanical action of charcoal in water filtration?—It seems to have an attractive power on organic matter, and to draw the matter to the grains of charcoal; but it does not seem to me at all proved whether the action is purely mechanical, or whether there is anything which may be called chemical in it.

640. Do you know that, whether rightly or wrongly, or whether beneficially or otherwise, in all the filters which are sold in the shops the filtering medium is either wood or bone charcoal?—I believe that it is charcoal and sand.

641. And that filters are made with Mr. Spencer's carbide?—I do not know as to that.

642. If any beneficial results are obtained from household filters by Mr. Spencer's system, do you think that those results could be obtained upon a great scale at a less cost than the present results?—I cannot see any facility for carrying out the process of filtering large quantities of water through charcoal, unless one was going to construct works. I do not at present see my way to do it so as to obtain the benefit described.

643. What is the base of the filter bed, is it concrete?—Yes.

644. And then you have a series of drains upon that concrete?—Yes.

645. What do you fix in between the drains?—Large stones, and the coarsest gravel which I can get.

646. As big as my fist?—Yes.

647. And then you diminish the size until you get to the size of peas before you come to your sand?—Yes.

648. Of what depth is your sand?—It varies. I may take 18 inches as the normal depth.

649. Supposing that you put upon your peas a layer of any kind of charcoal of five or six inches thick, either wood or bone charcoal, or of carbide, all the water must come in contact with that charcoal until you get down to the drains?—Yes.

650. Do you see any difficulty in that?—No, it is the only way which I can see of using the charcoal.

651. (*Professor Way.*) Dr. Frankland has stated, I think, that 300 tons of charcoal would be sufficient for the whole water supply of London?—Yes, but Dr. Frankland does not imagine that it is used in your way. He thinks that after the water is filtered it

LONDON.

Mr. C. Greaves.

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may be sent through some vessel in which a cage for the charcoal can be put, but that I think is altogether impracticable.

652. (*Chairman.*) Professor Way, I daresay, will tell you what the chemical action of charcoal is, and that it is necessary for the water to be in contact with the charcoal for some time; and that pouring a large quantity of water through a minimum amount of charcoal, will do a minimum amount of good, or no good; and that if you are to do it upon a great scale, it must be somewhat in the way which I have sketched out to you?—Yes.

653. (*Professor Way.*) The price of the carbide is 10*l.* a ton, and the price of animal charcoal I think is generally about 12*l.* a ton, so that there is not much to choose between them?—Just so.

654. And if Wakefield can afford to use carbide in the way in which they use it, they can afford to use animal charcoal?—Yes.

655. (*Mr. Harrison.*) Can you state whether the population in the neighbourhood of the river is increasing between the point from which you take the water and Hertford?—It is increasing very greatly in the neighbourhood of the river; Cheshunt is a very increasing town.

656. Considering the position of the point from which you take the water of the river Lee, and the large population on its banks, with every care which may be taken, do you think that the river Lee at that point would be a proper source from which to derive a water supply for London?—If a reasonable authority is used in excluding the sewage the river is as pure there as it is further up, because it suffers no other contamination.

657. You do not think that the refuse matter from that populous district, which must more or less find its way into the river, would cause that river to be an objectionable source of supply?—No. I do not see anything there, other than domestic and house sewage, which would be liable to contaminate the river.

658. (*Chairman.*) Is there anything which you wish to add to the evidence which you have so kindly given us?—I do not call to mind anything now which would help to elucidate this matter, or which would affect anything I have said.

The witness withdrew.

Adjourned to to-morrow at half-past 10 o'clock.

APPENDIX No. 1.

To the Evidence of CHARLES GREAVES, Esq., Engineer-in-Chief (referred to supra, Question 253).

The number of fire plugs in the East London District in the public streets at Christmas 1866, were 9,292.

(Signed) CHARLES GREAVES,
Engineer.

APPENDIX No. 2.

To Evidence of CHARLES GREAVES, Esq., Engineer-in-Chief (referred to supra, Question 309).

PROPORTION OF HOUSES HAVING CLOSET FITTINGS IN PARTS OF THE EAST LONDON DISTRICT.

No. Houses.	No. having Closet Fittings.
5,938	4,509
8,474	4,611
1,984	1,402
14,394	2,866

(Signed) CHARLES GREAVES,
Engineer.

APPENDIX No. 3.

To Evidence of CHARLES GREAVES, Esq., Engineer-in-Chief (referred to supra, Question 337).

EAST LONDON WATERWORKS COMPANY.—DESCRIPTION OF TRADES AND LARGE CONSUMERS USING WATER BY METER, ALSO VOLUME OF WATER COMPUTED DELIVERED.

Ale and bottle merchants.
Almshouses.
Asylums.
Baths and washhouses.
Biscuit bakers.
Bone boilers.
Braid manufacturers.
Brick makers.
Brewers.
Cabinet makers.
Chapels, churches, and colleges.
Chemical and colour works.
Chocolate makers.
Coal companies.
Coopers.
Confectioners.
Curriers.
Distillers.
Docks, wharves, and ponds.
Dyers.
Engineers.
Fish curers.
Ginger-beer makers.
Gardeners.
Gasworks.
Gunsmiths.
Guttapercha and rubber works.
Harp string makers.
Horse slaughterers and butchers.
Hospitals.
Ink makers and printers.
Laundries.
Maltsters.
Oil refiners.
Paper makers.
Pickle makers.
Police stations.
Potters.
Provision merchants.
Railways.
Road trusts.
Rope makers.
Saw mills.
Scum boilers.
Sewers.
Shipbuilders.
Soap makers.
Stables and cowhouses.
Sugar refiners.
Sundry trades.
Tobacconists.
Tripe dressers.
Urinals.
Water troughs.
Water sellers.
Workhouses.

WATER COMPUTED DELIVERED TO LARGE CONSUMERS AND TRADES.

	Gallons.
1857 - -	748,703,199
1858 - -	903,127,399
1859 - -	1,028,261,850
1860 - -	1,090,219,200
1861 - -	984,683,524
1862 - -	1,126,835,850
1863 - -	1,239,557,550
1864 - -	1,273,931,400
1865 - -	1,488,809,700
1866 - -	1,515,045,000

(Signed) CHARLES GREAVES,
Engineer.

APPENDIX No. 4.

To Evidence of CHARLES GREAVES, Esq., Engineer-in-Chief (referred to supra, Question 418).

EAST LONDON WATERWORKS.—LETHEBY'S ANALYSIS.

	1865.		1866.		1865.		1866.		1865.		1866.	
	Reservoirs.	London Hospital.	Reservoirs.	London Hospital.	Reservoirs.	London Hospital.	Reservoirs.	London Hospital.	Reservoirs.	London Hospital.	Reservoirs.	London Hospital.
	JANUARY.				FEBRUARY.				MARCH.			
	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.
Carbonate of lime and magnesia	13·5	13·0	12·1	12·8	12·0	11·2	13·3	14·7	13·9	13·1	16·1	15·6
Sulphate of lime	3·7	3·3	4·7	4·3	2·2	1·9	4·8	4·5	3·3	3·4	4·0	4·4
Alkaline sulphate	—	—	—	—	1·7	1·4	—	—	—	—	—	—
„ chloride	1·8	1·8	1·8	1·7	1·7	1·6	2·0	1·6	1·9	1·8	1·4	1·0
„ nitrate	2·4	2·2	3·7	4·4	0·4	0·5	1·1	1·0	2·2	1·9	0·9	1·3
Silica, alumina, &c.	1·0	1·0	0·6	0·5	0·6	0·5	0·5	0·6	0·7	0·8	0·6	0·6
Non-organic	22·4	21·3	22·9	23·7	18·6	17·1	21·7	22·4	22·0	21·0	23·0	22·9
Organic impurity	0·4	0·5	1·0	0·6	0·4	0·6	0·5	0·6	0·8	0·8	0·5	0·4
Total impurity per gallon	22·8	21·8	23·9	24·3	19·0	17·7	22·2	23·0	22·8	21·8	23·5	23·3
	APRIL.				MAY.				JUNE.			
Carbonate of lime and magnesia	12·0	12·8	13·8	13·5	10·5	9·8	13·9	13·1	11·3	12·0	11·4	11·2
Sulphate of lime	3·1	3·1	3·6	3·4	3·7	3·5	2·9	2·8	2·9	2·9	2·2	2·0
Alkaline sulphate	—	—	—	—	—	—	—	—	—	—	—	—
„ chloride	1·8	1·7	1·3	1·3	1·7	1·6	1·2	1·5	2·0	2·0	1·2	1·1
„ nitrate	1·5	1·0	2·6	2·6	0·9	0·6	3·1	3·6	0·2	0·5	2·5	2·0
Silica, alumina, &c.	0·7	0·5	0·3	0·4	0·6	0·7	0·5	0·3	0·6	0·6	0·2	0·5
Non-organic	19·1	19·1	21·6	21·2	17·4	16·2	21·6	21·3	17·0	18·0	17·5	16·8
Organic impurity	0·6	0·6	0·4	0·4	0·6	0·6	0·4	0·4	0·6	0·8	0·2	0·4
Total impurity per gallon	19·7	19·7	22·0	21·6	18·0	16·8	22·0	21·7	17·6	18·8	17·7	17·2
	JULY.				AUGUST.				SEPTEMBER.			
Carbonate of lime and magnesia	12·0	11·5	—	12·00	10·0	9·2	—	11·51	13·5	13·2	—	13·05
Sulphate of lime	2·9	2·9	—	2·42	3·2	3·2	—	3·05	3·1	3·1	—	2·52
Alkaline sulphate	—	—	—	—	—	—	—	—	—	—	—	—
„ chloride	2·0	1·9	—	1·32	2·0	2·0	—	1·52	1·4	1·4	—	1·27
„ nitrate	0·6	0·7	—	1·52	0·2	0·5	—	1·28	0·5	0·6	—	0·86
Silica, alumina, &c.	0·2	0·2	—	0·50	0·4	0·3	—	0·27	0·3	0·3	—	0·43
Non-organic	17·7	17·2	—	17·76	15·8	15·2	—	17·63	18·8	18·6	—	18·13
Organic impurity	0·5	0·3	—	0·40	0·4	0·6	—	0·56	0·4	0·4	—	0·39
Total impurity per gallon	18·2	17·5	—	18·16	16·2	15·8	—	18·19	19·2	19·0	—	18·52
	OCTOBER.				NOVEMBER.				DECEMBER.			
Carbonate of lime and magnesia	12·5	12·0	12·67	10·17	13·3	13·0	14·72	14·98	14·3	13·5	14·96	14·28
Sulphate of lime	2·8	2·8	2·82	3·39	4·1	3·8	2·97	2·97	4·5	4·7	3·68	4·16
Alkaline sulphate	—	—	—	—	—	—	—	—	—	—	—	—
„ chloride	1·8	1·8	1·27	1·58	1·9	1·8	1·02	1·01	1·7	1·6	1·42	1·42
„ nitrate	0·3	0·4	2·52	2·29	2·7	2·0	1·81	1·99	2·8	2·7	2·26	1·97
Silica, alumina, &c.	0·5	0·4	0·25	0·58	0·9	1·0	0·50	0·42	0·9	0·8	0·67	0·50
Non-organic	17·9	17·4	19·53	18·01	22·9	21·6	21·02	21·37	24·2	23·3	22·99	22·33
Organic impurity	0·4	0·2	0·56	0·68	0·9	1·1	1·08	0·72	0·8	0·9	0·84	1·16
Total impurity per gallon	18·3	17·6	20·09	18·69	23·8	22·7	22·10	22·09	25·0	24·2	23·83	23·49

Where there are two samples in a month, one is taken at Lee Bridge and one at the London Hospital. Grains per gallon are denoted throughout.

(Signed) CHARLES GREAVES.

APPENDIX No. 5.

To Evidence of CHARLES GREAVES, Esq., Engineer-in-Chief (referred to supra, Question 429).

EAST LONDON WATERWORKS.—SPECIAL ANALYSIS.

Extract from Dr. Letheby's Report on waters sampled August 9, 1866. College Laboratory, September 3, 1866.

"The following are the results of the analysis."

	Old Ford filtered. Grains.	Old Ford uncovered. Grains.
Carbonate of lime and magnesia	10·81	11·06
Sulphate of lime	3·45	2·91
Alkaline chloride	1·42	1·53
Alkaline nitrate	1·27	1·90
Silica and alumina	0·50	0·50
Organic matter	0·48	0·56
Total per imperial gallon	17·93	18·46
Hardness before boiling	12·5	13·5
Do. after boiling	4·	4·

These results show that practically the two samples are the same, the differences being too slight for any notable distinction.

The samples also correspond in quality with the other samples analysed during this month, namely; the samples sent early in this month and the sample taken from the main at the London Hospital.

	Sample from works.	Sample from main.
Carbonate of lime and magnesia	10·96	11·51
Sulphate of lime	2·91	3·05
Alkaline chloride	1·52	1·52
Alkaline nitrate	1·39	1·28
Silica	0·50	0·27
Organic matter	0·40	0·56
Total per gallon	17·68	18·19

These results are nearly the same as were obtained last month, and they are a little above the results of the corresponding month of last year, when the solid matter was about 16 grains per gallon.

(Signed) H. LETHEBY.

LONDON.

Mr. C. Greaves.

10 Dec. 1866.

APPENDIX No. 6.

To Evidence of CHARLES GREAVES, Esq., Engineer-in-Chief (referred to supra, Question 578).

EAST LONDON WATERWORKS.

RAIN PERCOLATION and EVAPORATION GAUGES kept by Mr. GREAVES at LEE BRIDGE.

	Rain.		Percolation.		Evaporation from Ground.		Evaporation from Water.	
1860.								
March - -	5·227		3·175		2·052		1.227	
June - -	10·520		2·387		7·133		8.645	
September - -	9·312		1·837		7·475		8·187	
December - -	7·499		3·662		4·136		2·998	
		32·558		10·761		21·797		21·058
1861.								
March - -	6·932		3·062		3·874		4·932	
June - -	4·141		·187		3·953		8·766	
September - -	5·374		·0		5·374		9·749	
December - -	7·852		2·762		5·090		3·727	
		24·299		6·012		18·287		27·174
1862								
March - -	6·645		3·437		3·207		1·895	
June - -	7·813		1.649		6·163		7·064	
September - -	5.332		·0		5·332		6·457	
December - -	6·791		3·462		3·329		1·916	
		26·581		8·548		18·032		17·332
1863.								
March - -	4·062		2·387		1·674		2·062	
June - -	5·270		·0		5·270		7·520	
September - -	5·206		·0		5·206		7·331	
December - -	5·228		1·374		3·854		1·354	
		19·766		3·761		16·005		18·266
1864.								
March - -	4·728		2·862		1·866		1·228	
June - -	3·770		·062		3·708		8·016	
September - -	3·936		·0		3·936		8·186	
December - -	3·457		·899		2·557		1·206	
		15·891		3·823		12·067		18·636
1865.								
March - -	7·145		5·425		1·720		1·770	
June - -	5·083		·025		5·057		8·208	
September - -	7·896		·837		7·059		8·646	
December - -	9·124		4·862		4·262		1·499	
		29·248		11·150		18·098		20·123

(Signed) CHARLES GREAVES, Engineer.

Victoria Steeet, Tuesday, 11th December 1866.

PRESENT:

ROBERT RAWLINSON, Esq., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, Esq. | Professor JOHN THOMAS WAY.

LONDON.

N. Beardmore, Esq.

11 Dec. 1866.

NATHANIEL BEARDMORE, Esq., examined.

659. (*Chairman.*) You are engineer to the river Lee navigation?—Yes, under the Trustees.

660. Will you state what their proper title is?—The Trustees of the river Lee.

661. Are they constituted under an Act of Parliament?—They are constituted under several Acts of Parliament, they were finally incorporated in 1850.

662. I presume that the most recent Act of Parliament defines the constitution and qualification and other particulars?—Yes; I have requested the secretary to prepare a short paper referring to those matters, which, when completed, he will put in.

663. How long have you acted as engineer for the Trustees of the river Lee?—For about 16 years.

664. For what distance is the river Lee navigable from the Thames?—From the Thames it is navigable to Hertford, a distance of about 28 miles. Bow creek is also under the jurisdiction of the Trustees; that leads from Bow to Blackwall, and is a natural creek of the Thames. The jurisdiction of the Trustees does not extend up the Stort branch, which is about 13 miles from near Hoddesdon to Stortford.

665. Does the jurisdiction of the Trustees extend to the junction of Bow creek with the Thames?—From Bow locks to the Thames there is a mixed jurisdiction, for the Thames Commissioners are as much masters there as the Trustees of the Lee.

666. Do the works belong jointly to the two bodies?—There are no works on that part; it is a natural river with banks, subject to the control of the Level Commissioners.

667. What is the length of that part of the navigation?—About $2\frac{1}{2}$ miles.

668. Then there are three bodies concerned in the lower or tidal reach of the navigation, the river Lee Trustees, the Conservators of the Thames, and the Essex Sewer Commissioners?—Yes, they have one side.

669. They have charge, I suppose, of all the lowlands, the marshes ditches, and embankments?—Yes.

670. I believe that body nominate three members on the West Ham Local Board?—Yes, they do.

671. Have you acted as engineer for the commissioners of sewers?—Yes; for several years.

672. Was Mr. Walker their engineer before that?—Yes. I was consulted by them for several years before his death, and two years before his death I was appointed.

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N. Beardmore, Esq.

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673. In constructing the Victoria Dock works, what body would have been consulted, the river Lee Trustees or the Essex Sewer Commissioners?—The Essex Sewer Commissioners entirely; the Victoria Dock works enter from the Thames. The Conservators of the Thames no doubt had control over the entrance works. I may say that great improvement in the drainage of the marshes was effected when these docks were formed, arising out of the construction of the docks, but their formation has also brought about complications as to the drainage which are still unsolved; on the lower side there is a strip between those docks and the Thames, which is awkwardly situated.

674. Do you mean the part on which Silvertown is erected?—Yes, it is quite out of the Lee.

675. That strip, by the construction of the Victoria Docks, has been cut off from the general area of the marsh?—Yes, but it does not suffer so much for that reason; it is becoming a great town, and the West Ham local board has not yet constructed sewers there; it is a very difficult thing, unless some new scheme is introduced, for them to do it.

676. At what date was the river Lee first formed into a navigable river, was it navigable before there were locks upon it, or do you know the origin of the navigation?—Our first navigation Act was passed in the reign of Queen Elizabeth, but it must have been a navigation of some kind long before that. I have little doubt of that, because the Danes went up the river Lee in the time of King Alfred as far as Ware, but no doubt in those days the marsh was more of a morass, and consequently the navigation would have been easier. I have no doubt that in those days there were rough kinds of weirs, that is the original kind of weir; whether there was anything like a scientifically formed weir I should have a doubt, but I think there were most likely weirs to fish with, with arrangements for boats to go through, and for the trouble taken in letting them pass through a toll was paid; we know that a toll exists to this day. I have very little doubt about it, because I have seen the same on some of the rivers on the continent. Those who had fishing weirs, made arrangements to pass the barges, and they were paid a trifle for each; there is a vestige still left of the the old weirs, and the property in them has come down by inheritance; when we dredge in the present river we now and then come across one of these old weirs. After Queen Elizabeth's time they became regular weirs formed by the commissioners; they were made scientific constructions, and the old weirs exist in the bottom of the river to this day; there is one close below Ware, and that has not been used for 100 years.

677. (*Professor Way.*) I suppose as there is nothing above the water there are no tolls levied now?—No. When Smeaton formed his design for canalizing the river, the weir owners evidently appeared in Parliament and made the Trustees pay them compensation for abandoning their tolls, and fixed payments were maintained in the Act that was passed. As to some of them we do not know where they existed. I do not know at least where one or two of them did exist, and yet a sum of 20*l.* or more a year was paid for them in compensation. A man would have said, you will destroy my property by making the new cuts, and therefore you must pay me. These places are spoken of in our Acts of Parliament as turnpikes, I believe legal ones; since Elizabeth's time they were, I think, treated as turnpikes; they may have varied in construction, but no doubt the system still exists, and you can see it upon other rivers. In the first place two piles were driven down into the river at a distance apart which would admit the largest barge, then there were sills, and those piles were connected with the shores by wings; on one side of the piles there was an iron pin, and a beam swung upon that iron pin; this was the turnpike, that beam was confined at the other end, and then upright boards were put in one after the other to pen the water up.

678. (*Mr. Harrison.*) There are such weirs existing now above Oxford on the River Thames?—Yes; and also on the river Nene and on another river near Bury St. Edmunds. We have, as I before stated, from time to time grubbed up these materials, and I rather guess that they were of the form I have described, and that the turnpike was that swinging beam; from which we get the name of turnpikes on the roads. Tolls are mentioned as payable at such places as Waltham turnpike, which is a water passage on the old river.

679. I suppose that the name "Ware" comes from a weir on the river?—I have not the slightest doubt of it.

680. What is the geology of the Lee?—Down to the parallel of Cheshunt it is chalk covered by beds of sand, gravel, drift, and clay; some small extent boulder clay exists still in part of the valley, and the district varies greatly in the amount of the drift. Some of the upper valleys have vast beds of gravel, sand, and tertiary drift; there being in some other valleys surface clay, and patches of boulder clay.

681. If you could strip the alluvium from the chalk you would probably find a distinct set of contours and pot-holes in the chalk?—Certainly.

682. The valleys between the ridges and pot-holes are filled in by drift?—Yes.

683. Therefore, I assume that a bore-hole in any one part of the valley would not be a sure indication of what it would be in another part of the same valley?—When you come to the higher parts of the valley, there you would always find chalk nearer and more certain; but the valleys themselves vary greatly in the amount and character of the drift. The charm and beauty of the Lee, as a water bearing country, are in fact that it is a great natural filter; there are some of those streams above Hertford that never flood nor overflow except with very unusual rain. When the Great Northern line was cut, you could see the beds of fine sand running from 10 to 15 feet thick, and those beds prevail largely; indeed over at least 150 out of the 444 square miles above Fielde's weir, they are of that fine character.

684. Would you say that the Lee is essentially a spring fed system of rivers?—Most essentially of the spring water character, surface water drains out within three days of a flood, sometimes within two days; in the earlier part of the winter and in the spring the flood water passes off, and the gauging shows that the river is mainly composed of spring water almost immediately.

685. (*Mr. Harrison.*) With almost a steady supply?—Yes. During the last month we had a flood, and within a week the river had gone back to its normal spring volume.

686. (*Chairman.*) Are you able to name the principal springs upon the tributaries and upon the main river of the Lee, where they are situated, and their probable volume?—The river Mimram is a large spring of water. The rivers Beane, Rib, and Ash to a great extent are composed of spring water, but with no very large springs on either of them showing anywhere.

687. (*Mr. Harrison.*) Do you find that there is an accession of spring water into the beds of those rivers throughout their course?—Yes; they are so highly porous that the springs must come from the hills into the marsh, and then down into the bed of the river; they are not very perceptible.

688. There is a constant accession of volume as the river proceeds?—Yes. On the river Mimram I do not think it is possible to build so as to foul the stream unless you have pipe drains. It is absolutely a rural district, and there is nothing to foul it. It is so porous that it would be difficult to do it, except by pipe drainage going down to the Lee Proper. The upper part rises with springs direct out of the chalk above Luton. The river has a gradual accession of water, but not by means of any large prominent springs that I know of until you get below Hatfield, and even there I know that the bed of the river is a vast deposit of sand. It flows in a porous sand bed with

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chalk not very far off; the water passes through the sand, and in a very dry time portions of the valley will drain by natural filtration. Two miles below Hatfield the springs present themselves in a very large form; they are to be seen boiling out on the hill sides. There is one very considerable spring at Woolmer Park, but that spring being one of the higher springs fails in a dry year, for at least three months. In the last 15 years that spring has twice fallen off from August to October.

689. (*Chairman.*) Is that a spring which is known in some districts as a levant, or in others as a bura, or are there intermittent springs which appear and disappear?—We have no such name; it is a fine boiling pool, under a chalk cliff. You can see the gravel and sand on the chalk when not grown over with shrubs and creepers.

690. You say that it is intermittent?—Yes, so far so that in a dry year it has fallen off and come to nothing.

691. The flow ceases?—Yes.

692. Do you know the Bourn at Croydon?—Yes.

693. Which only breaks out after there has been a certain rainfall?—I know nothing of that kind in the Lee valley; it is all too highly porous and consequently the flow is more regular. These springs doubtless prevail, but not visibly, all the way down to Hertford, because the Lee Proper increases in volume and becomes there a very considerable stream. Below Hertford the first large spring that you meet with is the one that was taken originally by the New River Company, the Chadwell spring, which is between Hertford and Ware; below Ware, the western side of the valley becomes a succession of boiling springs all the way down to Hoddesdon; the last great spring is at the Hoddesdon Mill. The volume of that spring is not less at any time than 300 feet a minute. There appears to be a fault in the valley at Broxbourne; I think the London clay exists below the parallel. Comparatively speaking there are not many springs below that point, but if you bore through the clays and drift you will find boiling springs again, showing that the whole valley is full of springs which cannot come out on account of the weight of the clays, the mottled clay, and the London clay lower down than that. These springs will boil up as far down as Edmonton. There is one which has been bored within seven years, which is now running over in ample volume at the roadside near Angel Road Station.

694. The word "boiling," I presume, is not used as having any application to heat, but simply to coming up and flowing over?—Merely this, that they come upward and flow entirely over.

695. Did you ever test the temperature of any of those springs?—I have often tested them.

696. What is their mean temperature?—According to the season; they vary from 51° to 53°.

697. Or from 48° to 50°?—I do not think that the mean temperature goes as low as 48°. They vary with the latitude.

698. (*Mr. Harrison.*) Will they not vary to some extent with the depth at which the spring is seated?—I think you would get in the winter a more uniform temperature, nearer the mean temperature of the latitude; less according to the mean temperature, and more according to the latitude. A deep spring will vary less, and that is the difference.

699. (*Professor Way.*) If the springs are in large volume, I suppose the surface does not affect the temperature?—No, they follow a fixed law. I tried some springs the other day in the centre of the coldest part of Russia, and they followed the same law.

700. (*Chairman.*) Have any records of the rainfall been kept upon the river Lee?—Yes, I have kept one at Fielde's weir for 16 years.

701. Shewing the least and the greatest rainfall, and about the average?—Yes, and I will put that in. (*The witness subsequently furnished the same. It will be found printed at the end of his evidence, Appendix No.* 1.) About four or five years ago I published a statement, and that I will refer you to; it gives almost as good a statement for 10 years as you can have. You will find it at page 346 in the tables contained in "Beardmore's Manual of Hydrology, 1862." (*See end of this witness's evidence, Appendix No.* 6.)

702. Have you any gaugings of the flow of the water, its minimum and maximum, at any fixed points upon the river?—I have kept for 16 years gaugings at Fielde's weir, where I consider the maximum of the spring water obtains, or nearly so.

703. What variations have you found in the flow of of the water;—The variations between a wet year and a dry one is very considerable, and perhaps I might almost say that that would be rather better given in the form of a table, for it is so very difficult to give all the figures in any other way.

704. Will you be good enough to give us the highest and the lowest and the mean?—I will refer you to the best gaugings on the Lee; that I can supply, at page 151 of the same book (*see end of this witness's evidence, Appendix No.* 2); but I will also furnish you with the details of the year 1858. (*The witness subsequently furnished the same, and it will be found printed at the end of his evidence, Appendix No.* 2.)

705. (*Mr. Harrison.*) Referring to that former table, can you give the rainfall down to the present time?—Yes, I will give you a further table. Referring to the minimum flow of the river Lee, at Fielde's weir, I think the years of 1857–58 will afford a good specimen; in that year the minimum of the month of August, after the New River Company had taken its supply, was 2,073 feet per minute, but for supply purposes you should take the mean of that month; in August 1857 it was 3,654 feet after the New River Company had taken their supply.

706. Was that the dryest season?—Yes, that I consider to have been a very dry year. We had also a very low discharge in October 1854. The mean of that month was only 3,041 cubic feet per minute at Fielde's weir after the New River Company had taken their supply. Under such circumstances you may take it, according to my experience, that it was entirely and absolutely spring water.

707. Can you give us the volume in September 1865?—The mean flow of the river at Fielde's weir was 4,550 cubic feet per minute, inclusive of the water flowing towards London through the New River.

708. Have you a return which has been kept continuously of the volume of water passing down the river?—I have kept records continuously, but they are not yet calculated up. I do it entirely as an amateur matter, but I have not got them yet quite complete. I will have some of them prepared.

709. (*Chairman.*) With the knowledge you possess of the river and supposing that the navigation question could be superseded and the water supply could be made permanent, would it be difficult to secure for the metropolis a supply of spring water at all times, putting aside also the amount of money that might be required to accomplish that object?—Not in that sense I think, because the spring water flow is collected from such a large area, and you must have the surface flow mixed with it when there is rain.

710. You think that you could not insure, by any system of collection or by conduits, a supply of the largest volume of spring water the river and streams are capable of yielding?—I think it would be a very difficult operation and an expensive one, for you would have to drive into the very neighbourhood where your collecting places would be liable, from being lower than others, to collect the foul drainage, in that would be the difficulty, because the whole valley is so porous, that driving for springs in that way must lead to your getting sewage and drainage water.

711. (*Mr. Harrison.*) You mean that at present the water comes from below, and if there was sewage or any matter of that kind above it, and you were to tap from below, the sewage would follow and be mixed with it?—That I think would be the difficulty. Take the valley below Ware as an example; at the bottom of the valley drift there are large boulder stones, and even in some cases rubble chalk, that have fallen down

from the hills, this substratum is teeming with springs, and when they boil out they flow over the ground and come into the river. The difficulty of the sewage question is that by touching anything like the valley itself you would run the danger of getting the sewage into the water ; at the present time from a large majority of the buildings along the valley the sewage never gets to the river at all, they have cesspools of their own and drains and ditches and so on and it filters through and evaporates.

712. (*Professor Way.*) To carry out the supposition of the chairman, if any scheme could be devised with any hope of success for securing a supply of spring water, the interception of the sewage would in all probability form a part of that scheme, so that the fear of pollution would not exist ?—You must keep them very clear of each other, and I fear if you did that to any beneficial extent your volume of water would fall off and you would not have supply enough ; you would have to be so careful to shut out foul drainage, that you would have to shut out clean water. This difficulty has arisen at Hertford ; the town was sewered by the New River Company, with the object of carrying the filth past and below the point where they took in their water, it being manifest that the town standing so close to the source of supply did not give nature any time to act to get rid of the bad effects of the sewage ; the town was sewered through open gravel and the consequence has been that the New River Company have drawn a great quantity of fine spring water into their deodorising beds, which is a waste of the water, and oftentimes there is a very great difficulty in deodorising ; they could not help it, for when the sewer was laid down in came the clean water.

713. If the bed had been dry the sewer water would probably have mixed with the spring water at another place ?—Yes, it might.

714. (*Chairman.*) At the present time works are being carried out on a gigantic scale on the south side of the river ; they have also been in progress on the north side for the low level metropolitan drainage. Do they, or do they not, shut out the foul water from those sewers ?—They do not, I should say, shut out any ; they have sucked out the water from everywhere. I was concerned in a case at Hackney where it was found that the sewer had taken away everything from some very valuable springs which used to supply some ancient watercress beds which were originally established there in Sir Joseph Banks's time.

715. Do you think that that is an absolute taking away of water by the internal conduit, or a draining away along the external line of the sewer in the gravel from the ground having been broken ?—Originally, no doubt, it was a draining away on the outside, but I believe it got into the sewer eventually somewhere.

716. That is to say by filtration or bad joints ?—By bad joints I should think.

717. I think you will find that Mr. Bazalgette, who is the engineer for the works, professes to keep the drainage out ?—They say that not a drop came in in the first instance. The impossibility of doing this, however, was shown in the Lewisham road case. The Kent Waterworks Company contributed towards the construction of a sewer for the sake of carrying the sewage from the Crystal Palace away from their source of supply ; the sewer was laid in drift of precisely the same character as the drift in this case ; the springs poured into the sewer and they never succeeded in keeping them out. The springs disappeared from the ornamental gardens and from the brook altogether, and the Kent Waterworks Company have in consequence entirely altered their system of supply. The sewer took the brook water as well as the sewage, every effort was made to keep the water out and enormous expense was gone to to line the sewer, but in spite of everything the springs blew in the work. I do not mean to say there are many such springs within the metropolitan area as would act in a similar way and you may be correct in thinking that the drainage of the water is by the side of the sewer and that it gets away, but if you were to apply the same law to collecting sewers up the valley of the Lee you would find the same thing happen. I myself built a lock near to the Amwell springs, and it was blown up by the springs just as if a barrel of gunpowder had been placed under my works.

718. The springs lifting the work bodily ?—Yes, and blew it up ; the difficulty there was enormous. I got down into boulders, chalk and large boulder-stones which prevail there, and the water boiled up in a manner that I had never seen before. In the Lewisham sewer, a year after it was made, you could see the springs boil up in the middle of the sewage from the bottom.

719. (*Mr. Harrison.*) Before the passing of the sewage into the metropolitan sewer, did not a large party of gentlemen pass through on the occasion of the sewer being opened, and go and inspect the reservoirs ?—Yes.

720. At that time was there any water coming in to any great extent before the sewage entered ?—That I cannot speak to.

721. Do you not think it would have shown itself then ?—I cannot tell you, but where the metropolitan middle level sewer goes there are large beds of gravel which are full of springs, and they have had to lay little pipes into the sewer by scores, so that anybody might now go into the middle level sewer in Finsbury and Bethnal Green and collect sweet drinking water fit to supply the population if it were not for the locality.

722. Do you think the springs are under considerable pressure there ?—No. That sewer is constructed as it were on a hill. It is not the condition of things that I spoke of before where the springs boil out on the river Lee, but the springs generally flow in through pipes. You may see them in the sides of the middle level sewer.

723. (*Professor Way.*) The engineer of the metropolitan board, I think, does not say that the subsidiary or secondary sewers are water-tight by any means ; he only claims exemption from leakage in the main sewer. The water that you speak of may come in at some short distance from, but yet not in the main sewer ?—Yes, that is what I mean. The water may pass along, and by and by it will come to some place where they have put a pipe in and so it is let in.

724. (*Chairman.*) Is any part of the river Lee embanked above the tidal influence ?—Small portions of the navigation are embanked, which has the effect of keeping the floods off the neighbouring lands, but not to any extent, or beyond what is necessary for the due management of the river itself.

725. Up to what point in the Lower Reach does the tide flow ?—A very high tide would tail up to Lee Bridge mills.

726. How many miles up would that be from the Thames ?—Five miles.

727. Is there any record to show the period when the river Lee and the Thames along the marshes there were embanked ?—No, but it must have been at a very early date. We know from the annals of the city of London that the corn required for the use of the citizens was ground at the City mills at Stratford, and those mills could not have existed without embankments ; they were essential to them. When I say that no part of the river Lee is embanked, I exclude the part which lies below Old Ford where it is all embanked.

728. What is the rise from the Thames up to the highest point to which the river can be navigated ?—The highest point is 119 feet above Trinity high-water mark ; that is the level of Hertford Pond.

729. What is the whole distance ?—It is nearly 28 miles from Limehouse, taking the whole length.

730. What number of locks are there upon that length of the river ?—There are 20 locks, besides six extra flood and tidal locks or stop gates.

731. At what date was the earliest masonry or timber lock of an ordinary character constructed on the river Lee ?—They were built by Smeaton. I have

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always considered them to have been built by Smeaton between the year 1770 and 1780.

732. They were perhaps the first that were constructed in England?—I do not know.

733. It has been stated that Brindley constructed the first locks on the Bridgwater canal, but that is not correct?—I should think so. I believe that ours were not the first that were constructed in the country.

734. Is it your opinion that Smeaton was the first person who improved the river Lee navigation?—We know that he laid out the works, and that they were executed under his general advice. No doubt other engineers were called in occasionally, but Smeaton laid out the line of the navigation as it is defined by the Act 7th Geo. III. cap. 51. His works have since been improved on the same general course.

735. Are all the locks now in existence that were designed and constructed under Smeaton?—Many have been removed and others altered in situation; the fall of two or three locks has been concentrated into one in several places.

736. Were they made of timber, or brick, or stone?—The waist, platforms and foundations were of timber, but the upper and lower recesses for the gates were of brick.

737. I suppose with piling between?—Yes, there were piles placed about 16 feet apart with horizontal campsheeting.

738. What is the greatest and the smallest lift?—Smeaton laid them out for about a maximum of three feet draught of water, and a rise of about four feet, but now they have been very much increased. The width of his lock was 13 feet, but the width of the present locks up to Enfield is now 18 feet 6, and above Enfield the locks are made 16 feet wide.

739. What is the length of the locks?—96 feet from centre to centre of the gates.

740. What is the greatest lift that you have on the river Lee?—About 9 feet 6, except at the tidal lock at Limehouse; that will lock down to 13 feet fall, according to the tide. There is no doubt that a line should be drawn in forming locks so that there should not be less than 6 feet, nor more than 9 feet of fall The loss of water is enormous in a 9-feet fall, and the loss of time as well, with a greater fall.

741. Have you what are termed side ponds on any of your locks for the purpose of economising water?—There is a lock at Tottenham which has a side pond.

742. Does that enable you to save half the water?—Yes. We have also double locks at Old Ford, and they can be worked one against the other as side ponds. Those works were carried out in the year 1856.

743. (*Mr. Harrison.*) And since you have been engineer?—Yes.

744. (*Chairman.*) What is the present draught of your boats and the tonnage?—The present draught is four feet in order to get to Hertford, and six feet to get to Enfield. With regard to the tonnage, the maximum tonnage that can be carried to Hertford now is about 85 tons, and that with difficulty. The maximum tonnage that could be conveyed to Enfield would be from 100 to 110 tons.

745. Is there any steam navigation on the river Lee now?—Not practically to any extent. The Trustees do employ a steam barge, which answers well and has done a great deal of work.

746. Is there any steam towing or are the barges themselves worked by steam?—No, not besides the Trustees' own steam barge, excepting this, that the Grand Junction Canal Company send a pair of boats to Enfield lock now and then, but that is not done to any very great extent; they have steamers on their canal and they send a pair of boats sometimes which carry iron to the Royal small-arms factory at Enfield.

747. Is the towing done by horses?—Our towing is done by horses entirely.

748. I assume that the towing-path belongs to the navigation, but do the powers of the trustees extend to any defined line beyond the towing-path on one side and the water on the other, or do the water and the towing-path limit them on both sides?—Except on the old river, the bank on one side and the towing-path on the other are the boundaries on the cuts which form the major part of the navigation as defined on the section I have put in. The foot of the bank on each side is the boundary, or where there is no bank there is generally a defined boundary, but upon the newer portions of the river the Trustees have acquired land with fixed boundaries; they have a good deal of wharfage ground.

749. When the navigation was first formed and before much improvement had been carried out, do you know what the practice was, if the channel altered its course in any way, or the towing-path was washed away. Had the Trustees power to form another, irrespectively of any riparian rights to keep up and maintain their navigation?—I believe that the Trustees were kept to their line as a general rule; whether in olden times they did not evade it and whether they did not gradually encroach on the land is perhaps doubtful; but in my time, when I have had anything carried away during a flood I have attempted to restore it.

750. Is the ownership of the soil vested in the Trustees, or is it claimed in any way by neighbouring riparian owners?—It is vested in the river Lee Trustees. The opinion of counsel has been taken on the subject, and the different Acts of Parliament distinctly vest it in the Trustees. In that respect the river Lee Trustees are different from any others in England, the soil is vested in them and they are a body corporate; they were made a body corporate in 1850.

751. Do you find that much or any dredging is requisite in order to maintain the navigation?—A great deal of dredging is required in the lower parts of the valley where the sewage comes in, and that is gradually increasing and more dredging is required.

752. What is the material that is generally brought up, is it gravel, or sand, or filth?—There are certain points such as Limehouse cut and the Bow river, and to some extent near Tottenham where what is dredged up is sewage; but we have been gradually deepening the river, and so up to this time we rarely dredge without taking a good deal of clean gravel out; that is in the lower part. In the upper part of the river there is very little to dredge out except gravel and sand, but at certain points were the cut is entered from the old river, the floods form banks of silt which has to be taken out. These, however, are localised points that we know, so that we can go to any point after a very heavy flood and do what is necessary.

753. Have you any surface scavenging carried out under your directions or have your banksmen instructions to scavenge and cleanse the surface from weeds and floating carcases?—Yes; we cut the weeds and we dredge on a regular system. The officers employed on the river Lee are required to get out and bury any carcases, but these are very rarely seen above Tottenham. Latterly, in the Limehouse cut and all the way up the river towards Tottenham, there are in hot weather a considerable number of dead dogs and other things, but we have systematically had them collected and buried, and so got rid of.

754. Have you laid down any regulations with regard to bathing within your jurisdiction?—No very strict regulations; we warn parties against bathing so far as our jurisdiction extends; but there are parts of the old river in a few convenient places where bathing goes on without any control being exercised by the Trustees, but not to any great extent.

755. Do the Trustees claim the ownership of the fishing rights, or do they in any way regulate or license the fishing?—No; the fishing generally is held by private owners; the Trustees by the right of purchase are the owners of some fishing; at all the weirs, they catch eels; but those fisheries are let where they are worth letting.

756. What mill power is there upon the Lee that belongs to or is in any way controlled by the Trus-

tees?—I may say, generally, that nearly all the mills from Ware to Lee Bridge belong to the two water companies or the Trustees, with the exception of one at Broxbourne and the Government mills, from King's weir down to Enfield.

757. What kind of mills are they principally?—They are flour mills almost entirely with one or two exceptions; there is a chain of powder mills from King's weir down to the small-arms factory at Enfield.

758. Which are the Government mills?—Yes, these all belong to the War Department who allow their surplus water to grind corn at Waltham, and the water power at the small-arms factory turns grindstones for sabres.

759. Do you know anything of the river tributaries beyond your jurisdiction above you and up towards the sources?—I know them generally.

760. Are there any mills on the tributaries?—Yes, a great many, but they are entirely corn mills; I think there is scarcely an exception; there may have been one small paper mill near Luton some years ago, but I doubt whether it is there now.

761. Do any of those mills that you know of use steam as an auxiliary?—Yes; steam has been very much introduced.

762. As an auxiliary to water?—Yes, as an auxiliary to their trade, the demand increasing. A man cannot work a mill to any advantage unless he can draw plenty of wheat through it, and so he puts on steam; it is not altogether an auxiliary to water.

763. I need not perhaps ask you whether you would restrict the putting of ashes into the river within your jurisdiction or not, but suppose a man burns coal to any large extent and he puts the ashes into the stream, of course, you would complain of that?—Yes; but I hardly think there is a ton of ashes thrown into the Lee in a month; they are too valuable.

764. Because they are so well checked within your jurisdiction?—Nowhere on the Lee is it done; there are no steam mills of any importance above us at all; within our jurisdiction I should say that there is not a ton of ashes thrown in in a month.

765. As to the condition of the streams above you, do you think that any solid refuse is put in by riparian owners or by persons having access to the river at any point?—A little perhaps at Stortford; it is not as sweet as it should be there, and I think there must be some come in from Ware.

766. You think that as a rule the river is not subject very much to abuse from being polluted by solids or obstructed?—As a rule, I think not much above Waltham.

767. Have the river Lee Trustees any jurisdiction above the point to which they navigate to prevent such a state of things if it exists?—The Trustees have no jurisdiction beyond being the body who can make a legal complaint to the Court of Chancery and obtain an injunction; they can do nothing more than that, and that is a most expensive and troublesome process.

768. You can put in force the common law of the land which is applicable to nuisances?—Yes, but not any special law; that is what the Trustees very much want.

769. There is I believe no such body as a conservancy having charge of the entire valley of the Lee and its tributaries?—No; that is what is wanted, and that is what did occur to me when I was called in in 1850 as being a most desirable thing to have, that the Trustees should be a drainage board as well as a river board.

770. You say that the river or the navigation is now managed by the Lee Trustees, but supposing that persons above your jurisdiction thought fit to abuse the river by casting in solids, there is no recognized body whose duty it would be to step in and immediately prevent it?—No.

771. The offenders would have to be indicted by any parties who chose to take the matter up?—Yes, they must either proceed by indictment at common law, or move for an injunction in the Court of Chancery.

772. Would you be surprised to learn that in Yorkshire and other parts of the kingdom ashes are thrown into rivers and streams by thousands of tons annually, that foundation materials and road scrapings are thrown in in the same large quantities, and in fact every form of solid refuse, and otherwise, is thrown in because a river happens to be near, and it is cheaper to throw it in than carry it anywhere else?—Yes, I am aware of it; but I can san say absolutely that such a practice as that does not prevail at any point in the valley of the Lee. The river is owned by millers and landowners to such an extent that they would immediately stop such a state of things, because if permitted it would immediately affect the next mill below. I can give you an instance; in Luton there was a board of health and some years ago they began to foul the river, but a large landowner close below commenced a Chancery proceeding against them, and he holds them under terror to keep all the solid matter back, and practically, I believe that Luton does not hurt the river in consequence. By clause 109 in the 7th of George the Third, it is enacted that "if any person "shall wilfully throw ballast or gravel into the said "river, cuts, or canals, he shall be committed and "put to hard labour for a period not exceeding three "months," but that only applies to the river as a navigation.

773. (*Mr. Harrison.*) For a considerable distance the navigation and the river run parallel?—Yes.

774. Have the Trustees of the navigation any control over that part of the river?—No, very little indeed; nothing more than if there was any overt act by which the river was damaged, coming in afterwards into the navigation, then the Trustees would, by common law, have a right to complain.

775. They do not take any steps to keep it at a proper depth, or pass over the water in any way?—They have no interest at all in any way in that.

776. There are some parts of the river which have been canalised?—Yes.

777. In those parts of it, are you obliged in the summer time to give any considerable fall to the water?—No, there are very fine deep reaches in the river very much like the Thames, and we keep them perfectly clear, we keep them regularly dredged.

777*a*. I see that you have deepened some of them considerably?—Yes; we also dredge after gravel for profit in some of these rivers, and some of them are very fine deep rivers.

778. In those parts where the river has been formed into a navigation, have your improvements had the effect of passing off the floods more rapidly than before?—Very much so; in the last 10 years the valley has been sensibly improved in its drainage by the works which have been carried out by the Trustees.

779. Does that remark extend to those parts of the river which do not form part of the navigation?—Not entirely, but partially it does. There are certain portions of the river, say between King's weir and Chingford on the Essex side of the valley, that are comparatively in their natural state still, because they are only relieved by the improved navigable river in one or two parts in the whole of that distance.

780. Is the effect of passing off the floods more rapidly from that part of the river which forms the navigation to expedite the passing down of flood waters from those parts which do not form part of the navigation?—Yes; all that has been improved, but there are portions of the valley which are left in their original state.

781. Has the effect of the improvements that you have made in the parts of the river that form the navigation been to pass off the floods more rapidly, but to pass them on to parts of the river not under your jurisdiction, and which remain in their primitive condition?—Yes, to some extent that is so; but as the river has to pass at many points through the new navigation, the general effect has been to get the water

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off the valley more quickly, at the same time, as I have said before, there are some portions between King's weir and Waltham and between Waltham and Chingford which are not much affected by these circumstances.

782. Would it be beneficial to the whole of the valley of the Lee if the other parts of the river were placed under the jurisdiction of the Trustees of the navigation ?—Certainly a great deal of improvement might be effected if there were means for it; some of the rivers are in a disgraceful state, the banks are allowed to grow up, and the place is left like a morass.

783. Is there much land flooded in consequence of that ?—Yes; there is a good deal of land overflowed by the floods, but that is in the winter months, and the lands are not very valuable; they are left in a half soddened state, and water logged, both from a wet winter and a wet summer; the people do not seem to value the lands much, and many of them are lammas lands.

784. That is to say, lands upon which the occupiers of adjoining land can put their cattle for a certain period during the year ?—Yes, but those lands are getting gradually enclosed.

785. Do you know whether the effect upon the health of the people is marked or not ?—The truth is that there are so few people who live in those water-logged parts that I cannot tell you, no one indeed lives there, they are neglected places.

786. Are the lands so injured by that condition of things that an improvement to the land would pay for an improvement to the river if it were placed under the jurisdiction of the Trustees of the Lee ?—If the commons were enclosed it would; not otherwise, as long as they are commons and open lands there is not sufficient ownership in them to make it worth while. When they get enclosed you soon see an improvement take place; they make partial embankments and deep ditches, and so on. We have had a marsh in Nazing opposite to Broxbourne very much improved in the last few years; besides being enclosed it was drained. The surveyor laid out a drain at my suggestion through that marsh, which has very much improved the land altogether.

787. (*Chairman.*) I assume that all those marsh districts are considerably above the level of West Ham marshes ?—Yes; they have got plenty of fall, all of them.

788. It would be simply a question of embanking and keeping the floods from them, and getting an outfall by a cut down to the lower district ?—Yes.

789. You could drain any one of them ?—Yes, and there is one very strong instance of that where I hope this will be carried out some day, and that is the large marsh which lies below Lee Bridge. That marsh ought to be enclosed and the river-course improved, and part might be laid out as a park for the people. I may mention that the marsh is very much frequented by the poorer orders of London during the summer time, and it would make as pretty a park as can be imagined, if properly laid out, with the river Lee like a lake in it.

790. Is that marsh now common land ?—Yes, and it is in a most disgraceful state.

791. Who is the lord of the manor ?—I do not know exactly; Mr. Tyssen is lord for part.

792. Is the valley of the Lee in any shape or way a manufacturing valley in any part of its area ?—Not in that sense above Enfield. The powder mills can be scarcely called manufactories, at all events it is one of the cleanest and quietest manufactures that can be carried on, they occupy about three miles of the river; but below Enfield we are gradually getting manufac-factories. One has been lately established as large jute works at Ponders End, and a large floorcloth manufactory has been erected in Edmonton parish. There are also some manufactories at Tottenham that drain into the Lee below Tottenham lock.

793. Is jute Chinese grass ?—It is a vegetable fibre that comes from the neighbourhood of Calcutta, an Indian fibre, and it is now forming the basis of everything; they say that they even adulterate silk with it. Nearly all the coal sacks and flour sacks are made of jute now; it looks like hemp, and it is a charming article, but it has one drawback, that it will not stand wet; wet causes it to rot immediately.

794. Are there any fords in the river in the valley of the Lee ?—There are a few fords in the old part of the river, but all the main lines of communication are bridged over entirely, and the old fords have disappeared.

795. Has there been any extensive system of land drainage in any part of the valley, or does the subsoil not require it ?—The subsoil does not require it, the river Lee valley is healthy for that reason; there is a wonderfully free percolation of the water through.

796. (*Mr. Harrison.*) In the upper parts of the basin which are chalk would agricultural drainage be at all affected if it were carried out ?—There is no occasion for it, it drains so excessively freely in the valley of the Lee. The malt trade of the Lee arises from the fine free quality of the land, growing as it does such excellent barley, it was carted down to Hertford and Ware and made into malt, and then sent by water to London; that was the origin of the Ware trade in malt.

797. No agricultural drainage would diminish the volume of water coming into the river from that area? —No, nothing could be done to affect that.

798. (*Chairman.*) In the course of our inquiries we have had very strong opinions expressed by many persons that from some cause or other, our climate is altering, that drainage or clearing of the land is gradually reducing the rainfall, and diminishing the floods. Do you believe that that is based upon any reasonable foundation; for example, taking the valley of the Lee, is that as subject to floods now as it was in a former period ?—I should think so. I believe that there is to some extent a popular error on the subject; floods will come occasionally in such a valley as the Lee, but a bad flood comes but rarely; there was a terrible one in the month of May 1824, and there was a very bad one in November 1852. Again there was flood that topped the one of May 1824 in October 1857, but since then we have had no flood at all that has been equal either to the one of November 1852, or the one in October 1857, so that I might say that now great floods seem to be disappearing, as we have had none for so long. I think people forget these things, and we might run on till such a period as has elapsed, as that between May 1824 and October 1857, before we get another. While the present elements of nature exist, I apprehend that we shall in this climate be subject to these irregular periods of drought, gradually merging into wet periods, which prevail according to something like a law. We got into a dry period in 1865, and no doubt we have run into a wet period again, we had a wet period in 1860 or 1861; the summer of 1861 was marked by floods through the summer.

799. In our first inquiries in Yorkshire, for the first 3 or 4 weeks every witness, without any exception, was quite satisfied that there would be no more floods, but before we had completed our inquiry there was destruction caused by a flood, such as the oldest inhabitant could not recollect ?—Yes, and so it will be everywhere, people are apt to forget what has already passed. There is one point touching this inquiry to which I may refer, namely, that in a valley like the Lee which is so full of porous grounds it is a long time before dry weather loses its influence. I attribute the low state of the river in 1865 to be the excessively hot weather of 1864. The wet marshes were cracked open, so that it was dangerous to walk across them between July and September, 1864; you might have dropped an umbrella out of sight in some of the cracks, many of which did not close up all the next winter of 1864–65.

800. And very probably they never would be watertight ?—The water certainly during all the next year did not appear as usual in the river; so that the cause of the river being so low in 1865 was the drought of 1864.

801. (*Mr. Harrison.*) What is about the level of the water shed of the river Lee within range of the chalk hills, how much does it rise above the sea?—The top of the range is about 450 feet, and the general average of the county round Hatfield may be said to be a great plain, with deep river channels cut into it; this table-land is from about 300 to 350 feet above Trinity high-water mark.

802. At what depth below that do the springs appear?—About 150 feet, they begin to boil out at about 150 feet below that level, and they cease to boil out when you got to about 80 feet above Trinity high-water mark.

803. Is that cessation in the boiling in consequence of the London clay overlaying?—I think so; underlying the drift and London clay, you get too far from the sources of the water to give fall enough for the water to come up with the same force, and you get an additional depth of drift and mottled clays, and then the London clays, which keeps down any tendency the water might have to rise. The Lee is a filling valley down as far perhaps as the parallel of Cheshunt; below that there is not much feed into it, except land springs and flood water. The lower part of the valley has a great thickness of pure green sand reposing on the chalk; near Ponder's End there is 70 feet of this material; the whole depth to the chalk being about 100 feet. At Tottenham lock the London clay is close to the surface, and is many feet thick.

804. You gave us the minimum volume of the water you had recorded as passing after the abstraction of water for the New River Company at Hertford?—Yes, as passing over Feilde's weir.

805. Where is that?—At the junction of the Stort and the Lee.

806. That is after taking in all the springs intervening between Hoddesdon and Hertford?—Yes, with one exception; that gauging does not take in a large spring at Hoddesdon. Hoddesdon mill and other springs are not included in that gauging.

807. Do you know what they are?—Hoddesdon mill spring discharges about 300 cubic feet a minute; 2,700,000 gallons a day.

808. There is a large drainage south of Hatfield where you may see plenty of swallow holes; Have you examined that district?—Not much.

809. It is of very considerable extent, is it not?—Yes.

810. All the water passes away?—Yes. I think they are not so much swallow holes as vast beds of sand. There may be swallow holes underneath and the water gets away. The bed of the river below Hatfield park has swallow holes. The Marquis of Salisbury took me last year over the bed of a pond on the river course from which he had diverted the river. He made a dam across the pond and laid one part of it dry and the water was going through the bottom of the pond, which was of fine sand.

811. That water no doubt passes into the chalk and finds its way out below?—Yes, not far below.

812. It was suggested to us in a former inquiry by Mr. Bailey Denton, that advantage must be taken of the drainage of the clays in certain places by passing it into the chalk in that way so as to increase the perennial supplies to the springs in the river adjoining; do you think that it is at all impossible?—I think there may be places where it would be very possible, but I could not apply such a scheme to any part of the valley of the Lee.

813. Go to the valley of the Stort; do you know the geological character of that valley?—It has a very great deal more of clay. The river Stort quickly floods.

814. Is it from the Stort that the floods chiefly arise in the lower parts of the valley?—Not chiefly, but in a great deal larger proportion than from the other parts. The river Stort is very foul when it floods.

815. Does it fall down to a great extent in a dry summer season?—Certainly it falls off comparatively to nothing, and in that respect it shows its clayey character.

816. Is that the case with the Ash also?—Yes, the Ash is a steep river also. I do not think that the Ash has so much clay in it, but it is a steep river, and it falls off very much. It floods rapidly after a certain amount of rain. None of those other rivers flood after the first rains. We have a regular monsoon in this country as in India. For example, we have our first warning rains, and then in October we have a heavy rainfall; it is very rare that we do not have a flood in October, when whatever collection may have taken place in the ditches of the upper country gets washed out and the water comes down very foul for the first 24 hours, when a flood has got to its maximum it comes down foul, but after that the water soon becomes clear. I can mention an instance which has occurred in the last week. The river was in a high flood on the 7th of this month and the water was then foul, but on the 9th it got nearly back to a fine and clear condition. I was surprised on Sunday to see it a fine magnificent volume of water, nearly clear, although so shortly after a high flood.

817. In the river Thames from observations that have been made by Mr. Simpson, it would appear to take nearly 30 days after a heavy general flood before the river assumes the appearance you described just now, indicating the springs at its source?—Yes, but it is very different in the river Lee, because we are so much nearer the spring head and get so much larger a proportion of water from the springs.

818. And more rapidly passed into the river?—Yes, I can assure you that it is a matter of fact that on the 7th of this month the river was in a state of high flood, and on the afternoon of the 9th one half of the whole volume of water was spring water. I know it by former gaugings, we had only got volume enough in the river, but so small a volume was it reduced to that one half of it was spring water; the river was falling off to a wonderful extent.

819. Have you made any observations at Hertford so as to determine approximately the quantity of water that is evaporated from the surface above Hertford?—No, but I know a great deal about it from the gaugings made at Feilde's weir, and from comparing the quantity that flowed off with the quantity of rain that fell.

820. Will you be kind enough to state the result of your observations there?—I will, if you please, answer that question by referring you to the table, where taking the depth of rain actually run off at unity, the rain gauge showed 4·26 in 1851; 4·35 in 1852; 4·29 in 1856; and 4·74 in 1858. In other words for every inch available as water supply in 1851 there was 4·26 inches of loss and so forth. (*See end of the witness's evidence, Appendix No. 2.*)

821. I believe the New River Company take water not only from the river Lee at Hertford and from the Chadwell spring, but pump also from wells?—Yes, they have pumps near the springs but they pump very little.

822. You stated, I think, that there would be a difficulty in drawing a larger quantity of water from the wells for fear of having the sewage flow back through the chalk or gravel; do you anticipate that that would be an obstacle to your drawing a larger quantity from the wells than you do now?—If the water had to be taken in that way upon a large scale, that is if it were collected by culverts upon a large scale, I apprehend that at the same time you would take care to have a proper system of sewerage upon a large scale, and I think that the two things together would be liable to clash. I have always looked at that as one of the difficulties in foul draining the valley of the Lee, that you must lay main sewers where the fine water is most plentiful. Wherever you attempt to lay a sewer in the valley of the Lee you find yourself taking in beautiful spring water. Carrying on works as I have done, I have found that when I have attempted to pump the river out in order to construct locks, it has been the most difficult engineering operation to get

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rid of the water that comes from everywhere, it is in fact to pump the whole district round.

823. Do the East London Waterworks Company take the water from your navigation, or from the old river?—From the old river. Under their Act of 1852 they were empowered to cut the navigation off from the old river in several places so that the old river became the carrier of pure water for miles above their point of abstraction; consequently their supplies are not affected by the navigation at all until above Ponder's End.

824. Then the navigation above a certain point acts partly as as a subsiding pond for their water supply?—Yes; if it does take in the sewage and the stuff carried down by the floods, it settles in other parts of the navigation.

825. At the lower part of the river you stated that there were two miles and a half which were jointly under the jurisdiction of the river Lee Trustees and the Thames Conservators?—Yes, we call it technically the Bow creek.

826. To what height do the ordinary spring tides rise there?—The rise of the bed of the river between Blackwall and Bow Lock is about 7 feet at low water, and the tide at Bow Lock rises 13 feet.

827. What is the difference in the level between ordinary spring tides and ordinary neap tides?—About 3 feet 6 at high water.

828. Is there any large extent of surface of the bank and bed of the river that is exposed between those two points during neap tides?—Yes, there is a good deal of bank, and all the Lee waters ebb out, so that the river is a mere stream at the bottom of a large muddy creek.

829. Therefore for some days there would be a considerable area left without being covered at all with water during the 24 hours?—Yes.

830. Of what area do you suppose that must be?—In acreage perhaps 10 or 12 acres.

831. What is the condition of that surface?—It is ooze and mud with a few reeds growing in it; there is a good deal of reed shore above the influence of the neap tides, but below the spring tides.

832. Is there much sewage matter carried up from the metropolitan outfall and from the West Ham works into that portion of the river Lee?—Since the middle of August last we have been very much relieved of anything from the metropolis, for they have set a temporary pump to work at the West Ham station, and they pump it now under the Lee, but there are many outlets still which are not connected so that we still have sewage coming in. There is a very annoying place at Bow brewery; there is also a newspaper factory and a soapworks near Old Ford that cause a great deal of nuisance; on the whole, however, we are very much better than we were. West Ham drains into the tidal creek below Barking iron bridge, and that does not help to mend the creek by any means; when the Metropolitan Board's pumping engines set to work at the Abbey mills, the West Ham drainage ought to be dropped in there; their culvert goes close to it, and some arrangement, I think, must be made to send it down there, unless the West Ham local board make their own pumping station near Barking. There is this disadvantage, that when the tide returns up Bow creek, it brings up anything through our flood gates; it flows to Old Ford lock on one side, and towards Limehouse on the other; but bringing in the sewage from the Thames, and being locked in as it is at Limehouse and at the Bow gates, of course what sewage there is drops to the bottom of the river, which renders it unwholesome in hot weather.

833. Is it worse than it was before the completion of the sewerage works?—Yes, it has very much increassd in the last year or two. Then the Tottenham drainage also coming in deteriorates the quality of the water, and we suffered very much from it, both in 1864 and 1865, and last summer but in a less degree.

834. Was there a considerable nuisance caused by it then?—Very great, and that is a thing that will grow, although they have taken it away from the metropolis. If something is not done with the Tottenham sewage above, we shall be liable to have the same nuisance where, until the last few years, it was a very beautiful river; that is, above Lee Bridge. In my opinion, some large scheme ought to be devised to carry away the drainage of the valley then.

835. It would appear that London has removed its drainage to your neighbourhood, and that you feel the disadvantage of it?—Yes; now that London has got rid of its difficulties the suburbs are increasing and the evils are repeating themselves. I have prepared this map (*handing in the same*) for the purpose of explaining the new state of things; this map is a general sketch showing the state of the valley below Edmonton at the present time.

836. Are you sufficiently acquainted with these parts (*pointing to the map*), Poplar, Blackwall, and Limehouse, to say whether they are above or below the level of high water?—The greater portion of that district is below the level of high water. In addition to that there was no efficient system of sewerage carried out; the inhabitants were of a very low class, and very badly built houses existed all over that district.

837. I believe the low level sewer has been partly carried out?—It was, in fact, at the time of the breaking out of the cholera, complete throughout the district but they had no outlet at the end. They are making from the low level, or they have made, a deep sewer into the Poplar district, running under the Limehouse cut at Bromley lock, which is just completed; one was also contemplated under the Victoria park approach to drain the Isle of Dogs.

838. The condition of this district (*pointing to the map*) at the breaking out of the cholera would be very similar, would it not, to the condition of that district on the south side of London where it broke out on a former occasion?—No doubt of it; and there was quite enough to account, I think, for the breaking out of the cholera, in the filth of some of the places here (*pointing to the map*), without looking to abstract theories. The first cases of cholera that we heard of at Bow were those of a man and his wife who worked in a small factory by the side of St. Thomas's millstream. A great many people work there, and in a very small building; they had an abominably foul ditch by the side of the factory, and this ditch was cut off from the general West Ham sewerage district, and was in fact illegally fouled by this factory and by some other nuisances above. The street in which the cholera raged so badly in Bow was close behind Lloyd's paper works, and the smell from a brewery and the stuff from Lloyd's paper works occasionally was of the foulest description. About six weeks ago I had occasion to visit an enclosure close by the newspaper works at the end of this street (*pointing to the map*), and I was convinced that there was quite enough to account for the cholera appearing there.

839. Where does the discharge from the paper works find an outlet?—Into the river Lee, close below Bow bridge. There was a smell from Esparto grass in the tanks. There was a sort of faint smell from it that was dreadful, and the closeness of the place was something worse than I ever experienced in my life, that was where the cholera broke out.

840. Is the part you have referred to below the level of high water?—No; it is on the side of a hill facing the east.

841. Are you aware whether there was any obstruction to the free passage of the sewage from Poplar about that time consequent upon the flaps being out of order?—I do not know. I had a great many men at work at Limehouse at the time, and knowing that cholera was raging so badly I of course made my inquiries, and it appeared that at the time of the outbreak there was scarcely anybody who was not seized with diarrhœa. I do not believe we had a man among the 60 who were there employed who was not ill in that way.

842. Was the effluvium from the river, and in the district bad at that time?—The effluvium was very bad.

843. (*Chairman.*) Do you know what the ordinary condition of Limehouse cut is?—The ordinary condition of Limehouse cut has been very fair during eight or nine months of the year ; but it has been very bad in dry, hot, summer weather in the last four or five years, within which period factories have been increasing, and sewage has been increasing from the metropolitan area.

844. It has been literally, has it not, an open cesspit?—It has been a good deal like it.

845. Was it not so in the last spring?—I think from about June.

846. When the cholera broke out?—Yes.

847. An open continuous cesspit?—Yes, as foul as it could be.

848. Are you aware that a barge load of blue vitriol was sunk in the middle of it, which throughout its whole length entirely disinfected it?—Yes. It must be remembered that we labour under other difficulties which must be explained. All the fresh water that we have flowing down the river is divided into five parts, so that several of these streams (*pointing to the map*) also are water-logged, and get foul. Then there is a reservoir there (*pointing to the map*) that it would be very desirable to close up ; it collects mud, and I think it ought to be closed up. An improvement might be made also in the drainage of this district and the cleanliness of it if there were means at hand. We can help ourselves in foul times by opening the gates at Bow locks into Bow creek. We do that, and we almost always do it on Sundays to clear it out and to draw the water off the land generally, but the collection of mud increasing in these other rivers (*pointing to the map*), there are dead ends to them that we cannot draw. Much good, however, might be done. We do all that we can to draw off the water from the surface, but the difficulty is this, when you get a very short water time and hot weather, the drawing off is no longer of any good, for the smell from the river that has been drawn is worse than when the river is kept up. The foul water that passes down Bow creek never gets away ; it is pounded up, and comes back to us the next tide. During the past two summers I was obliged to keep the water up instead of drawing it off. When the autumn water comes, or we have had a wet summer, we can draw these places off, and they can be kept comparatively sweet.

849. (*Mr Harrison.*) Have the trustees any control over these branches (*pointing to the map*)?—No ; they have no control over any but their own branch down to the Four mills. The others are private branches. One belongs to the East London Company, two to the city of London, and one to Christ's hospital. There are the means of getting a very great improvement made here (*pointing to the map*) ; this part might be very much improved if we could cut the river off there (*pointing to the map*) and turn part of this ground into a park. It is all open common now.

850. (*Chairman.*) Have you had any communication recently with the West Ham authorities relative to their sewerage?—The trustees of the river Lee have not had any communication with them, but the Essex Sewer Commissioners have had a communication with them. The Commissioners have offered to give them every facility they could, but nothing tangible has been done yet.

851. Had not the local board some understanding, or did they not obtain some sanction from you as engineer relative to their outlet?—Not the Trustees, but the Essex Sewer Commissioners sanctioned a new wall for passing the outfall through their embankment ; beyond that they have had nothing to do with it. At Barking iron bridge the Commissioners also sanctioned the making of another outfall.

852. (*Mr. Harrison.*) Is that portion of the land (*pointing to the map*) water-logged or liable to be flooded?—It is not flooded at all, or very rarely ; the West Ham sewers now underdrain it completely. There are still some islands above the Stratford road which are not connected with the West Ham sewerage, and they are more liable to be water-logged.

853. What is the substratum of this district (*pointing to the map*) which is marked "Poplar" and "Bow"?—It is a fine bed of gravel and sand.

854. How far does it extend from the river inland?—In all directions ; to Hackney, Homerton, Victoria park, and Bow common. They are all on a great bed of gravel and sand.

855. (*Chairman.*) All this district (*pointing to the map*) is more or less peaty and compressible?—Yes. The district I have just spoken of is bounded by the Limehouse cut and the river Lee. When you get into Poplar you get to the marsh in the same part of the river, there the London clay does not exist, and you have drift, and peat, and gravel.

856. Have you ever had occasion to use the ordnance bench marks in this part of the district (*pointing to the map*)?—I have used them.

857. I wish distinctly to say that any person wishing to refer to ordinance bench marks, ought never to refer to them anywhere near where the metopolitan drainage works have been carried out, or anywhere within the area of West Ham, or the flat district where the sewers have been carried out ; houses, streets, and bench marks have been lowered from 6 to 7 inches, and in some instances 12 inches by gradual subsidence from the draining of that site?—Your remark applies, I think, to the east of Bow creek. The West Ham sewerage drains that district very completely, and the only fault that it has is that it does not go far enough, it requires now to be carried farther ; a new outfall is wanted now at Barking creek or somewhere else.

858. (*Mr. Harrison.*) Were you consulted at all when the outfall was made for the West Ham sewerage?—Yes, so far I was consulted that I advised both the Trustees of the river Lee and the Essex Sewer Commissioners that the outlets must be only looked upon as temporary only, inasmuch as the metropolitan drainage works were then being commenced, and it was only a question of a few years when proper relief would be obtained for the district, without throwing the sewage into Bow creek.

859. The outlet was made under those conditions?—Yes.

860. So that the West Ham board of health are now under an obligation to remove the present outlet, and discharge the sewage at some other place?—Yes, and they must do it; it cannot be deferred much longer.

861. I dare say you remember that Mr. Simpson mentioned at the Institution of Civil Engineers, some gauging which he had made on the river Churn above Cirencester, showing that the volume increased from the Seven springs down to a certain point, and diminished after that ; so that at a certain distance below the source it was reduced to nearly the volume obtained at the Seven springs. Have you observed any such phenomenon on the river Lee as a loss in the volume of water below a certain point?—I have not in that sense, but I have no doubt that it does occur at Hatfield. I have no doubt that the river is lost to a certain extent and then comes out again above Hertford in the form of springs.

862. Can you say that from actual observation?—No.

863. Is there any stipulated volume of water for the use of the navigation?—Yes, that is all set out in the Act of 1855, the whole agreement in fact is embodied in that Act. The companies have their shares as between themselves, and with regard to the river Lee Trustees, a certain volume is set apart for the river Lee Trustees when they want it.

864. The volume which you have power to take is 3,500,000 gallons a day is it not?—The Trustees can take for the use of the navigation, from the upper reach above Feilde's weir 3,600,000 gallons per diem ; between Feilde's weir and Waltham 4,500,000 gallons per diem ; between Waltham and Old Ford 5,400,000 gallons per diem ; below Old Ford lock, all the surplus water belongs to the navigation. By the River Lee Water Act 1855 the Trustees are bound to undertake

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new works for improving the water supply at the expense of the companies if they require such; if consumption of water in the navigation is to be reduced the Trustees may be called upon to execute the necessary works under similar conditions; but practically there is not much water wanted for navigation, compared with the resources of the river. If the companies wish to exercise their powers we can reduce the quantity of water consumed in the navigation to a very small quantity. The quantity of water which the New River Company could draw before 1855 was limited by the marble gauge, but the Act of 1855 removed all restrictions and divided the water in certain proportions to the New River Company and the East London Waterworks Company, and then after these certain proportions had been received they took half, foot for foot, each of them. Under the powers of that Act, the New River Company laid down pipes past the marble gauge, and they also put in a new balance engine; their supply was very much increased indeed, no restriction was put upon it, and a new balance engine was put in, the old legal quantity was removed, that is to say, the quantity mentioned in the reports and so often spoken of as going through the marble gauge was altered by the Act of 1855.

865. (*Chairman.*) What is the working establishment employed by the Trustees?—It varies.

866. There is a paid secretary, is there not?—Yes, and a paid engineer, also bankmen and dredgermen.

867. Are they paid out of the funds which the Trustees have at their disposal?—Yes.

868. I think you have stated that the Trustees are not paid?—Yes.

869. Do you know whether they have any capital account?—Yes; we have always been carrying out large works on borrowed money.

870. They mortgage their income to raise the money?—Yes.

871. And they pay interest upon their debt?—Yes.

872. What is the present amount of the debt?—The clerk will be better able to state that.

873. Since you have been engineer to the trust have they expended much money on new works?—Yes, a very large sum.

874. Can you state the amount in round figures?—I should think they have expended at least 160,000*l.*

875. In what number of years has it been laid out?—In 15 years.

876. Was the whole of that money borrowed?—Not entirely. Under the Act of 1855 the New River Company contributed 30,000*l.* towards the works; the money was laid out specifically in new locks and works. The New River Company paid it in aid of a better water supply for the metropolis.

877. Has the East London waterworks contributed anything for similar purposes?—Yes, they contribute in the form of income.

878. Do you mean for works which have been executed?—I mean generally towards the funds of the trustees.

879. What do they pay you now?—2,000*l.* a year.

880. Is that 2,000*l.* a year to be a perpetual mortgage upon the trustees for works accomplished, or will it cease at any time?—No, it is a perpetual income contributed towards the resources and for the purposes of the trust.

881. In consideration of certain sums of money laid out at some former period by the trustees?—It was generally in consideration of sums to be laid out.

882. In the event of any conservancy being set up, do you think it would be compatible with the constitution of the trustees that they should become conservators if the necessary powers were tendered to them for acceptance?—Do you mean that they should become conservators and drainage commissioners?

883. Yes. Conservators and drainage commissioners for the entire valley of the Lee?—My opinion is that it would not be convenient for them to become drainage commissioners anywhere above Hertford. I think that above that town it should be left to the different local parts, but I think there should be power given to prevent nuisances being committed, and that some such powers should be conferred upon them, as have been recently granted to the river Thames Conservators, that is to say, if the authorities in any town chose not to drain properly, the trustees should have the power to go in and execute the necessary works, and charge the town with the costs, and levy a tax upon them. I am strongly of opinion that something of that kind ought to be done. The great difficulty is to force people to do what is right; unquestionably something ought to be done with the drainage of Bishop's Stortford, but unless the whole navigation of the Stort was vested in the Trustees, which might be inconvenient at the present time, because it is private property, it might be difficult to deal with it. I think that parties who are at such a distance as Bishop's Stortford should be left to carry out their own drainage, but that the Trustees should have power to go in and do it compulsorily, if after a certain number of years notice they did not do it.

884. The river Lee Trustees holding in trust the main navigation in the lower part of the river do in a measure hold the key to the whole valley, do they not?—Certainly.

885. Would it in your opinion be a convenient arrangement to establish a new form of conservancy to have jurisdiction over that part of the valley where they would be liable to come into collision with the Trustees?—I certainly think there would be no objection to that on broad principles, the subject is of course quite new to me, and in what form it should be I am not prepared to say.

886. You think there would be no objection to a new conservancy?—No, I think not as to the lower part of the valley; to deal with, say, the valley drainage below Enfield or below Broxbourne, something of that kind is called for because the Trustees now only hold the position of objectors general to everything, and it would be more convenient for everybody if they could say "Very well, "if you will not put this place to rights we will do it "for you and tax you for doing it." It certainly is a case, I think, in which it is possible to form such a body.

887. The Trustees you have said are unpaid?—Yes.

888. Then by what interest are they moved or what is supposed to be their interest in the navigation?—To keep it sweet and pure, that is all.

889. Are they large riparian owners?—Some of them are; not all by any means. The members for Hertford, Essex, and Middlesex are *ex officio* members of the board, so that in fact the whole of the contributing area is represented on the board.

890. When you have board meetings, does anything like the whole number of the members attend?—No; the *ex officio* members do not attend the meetings much. We emanated originally almost from the city of London, the mayor, the corporation, and aldermen are members of the board, and sometimes they take a good deal of interest in the meetings.

891. Is it true that the great mass of the business is transacted by a very few members?—Yes, there is a working board; I think that that works better.

892. Is the work done by a committee selected from the entire board and appointed by them?—No, it is not done by a committee but by the board.

893. Do you mean that a certain number are nominated by the rest of the members?—No, there is no nomination. Notices are given to the whole body; we have no committee for the monthly meetings.

894. But I suppose there are some members whom you never see, and others whom you see frequently?—Yes.

895. In the event of the Government desiring to interfere with the valley of the Lee and with the present arrangements for sanitary purposes, do you think that a large or a small board would be most eligible?—I really have not formed any opinion upon the subject, but practically our board may be called a small board.

896. Should a board having such duties to perform as those which are entrusted to it be, in your judgment, an unpaid or a paid board?—I think it would be rather better if there were a small payment.

897. Do you think it would come within the range of your duties to act as engineer for a conservancy board and at the ame time to act as engineer to the river Lee trust?—Certainly; the engineer of the river Lee could act much better and more effectually if he had the drainage under his control, and if there were funds to carry out improvements; the great thing is to have the sinews of war: you cannot deal otherwise with such a matter. The river Lee Trustees have no funds at present with which to deal with these things, and it is a great grievance, I think, to have perpetually to go to law for the purpose of restraining or punishing wrong doers.

898. Do you think that if the river was to be managed by a conservancy board for the benefit of the riparian owners and the towns on its banks; for the benefit also of the navigation and the different water companies, it would be an equitable and unobjectionable way of raising an income to levy a rate upon all persons who should be directly or indirectly benefited?—I cannot answer that question quite in the form in which it is put; my opinion is, however, that to a small extent taxation ought to be laid upon those towns that are drained into the river and who thereby compel the Trustees to incur expense in various ways. On the other hand the people might say, referring to the way in which you have put your question as to their being benefited, "We are not "benefited; it is true that our drainage is passed "into your river and you say that it may damage it, "but if you put us to any expense we shall not be "benefited." In the sense in which I have explained it I should be inclined to tax those persons whose drainage formed the very subject matter with which you had to deal.

899. Then you would take an area supposed to be directly or indirectly affected by the river and also benefited by the works which had been executed in it?—Yes, because the land to be benefited by mere drainage is practically *nil*. You could get no taxation out of any absolute benefit done to the land; you must take the broad principles as laid down in the Public Health Act and tax them broadly; not upon the old system, viz., that you could only tax parties whom a jury of 12 men would say were benefited; that is the essential difference between old sewer law and the new board of health law. The board of health takes a district; they do not look very minutely into the question of who is benefited, but they take a whole district, and they tax the people in that district.

900. From your knowledge of the valley of the Lee, do you think you could define a limit beyond which you should not go, but within which taxation should be imposed?—Not at the moment, but I think there would be no difficulty in doing so.

901. That will be a matter for consideration?—Yes.

902. The taxation you have suggested would be imposed under parliamentary authority?—Certainly, there should be taxation, but people should not be taxed by the Trustees direct, but a law should be passed as in the case of the county rate, to levy a certain amount of taxation on each district in a lump. The Trustees should not collect the money.

903. But do you mean it to be handed over to the fund in charge of the Trustees?—Yes.

904. To be expended by them, and that they should publish annually audited accounts?—Yes, I may say that the Trustees do that now, but no doubt there should be accounts published drawn out with great minuteness, and there should also be an annual report presented to Parliament.

905. For this purpose, of what do you think the establishment should consist in addition to a secretary an engineer and the staff which he might choose to appoint under him?—I should think not much more, there would of course be inspectors required, and they would act under the secretary or engineer. It would not require the machinery of a very extensive staff, but if such a plan were carried out there must be some very extensive works carried on in the neighbourhood between Tottenham and Stratford in order to get rid of some portion of the foul state of things which exists down there; that must be their work, and there must be a large outlay of capital if the works are to be completed, and a general system adopted; the mere working of the thing need not be an expensive matter.

906. In the event of any large works being devised and sanctioned by Parliament, or by some properly constituted authority, the engineer, I presume, would either let them by contract, or he would have power to call to his aid persons who were required to superintend and carry out the works?—Yes, the works would be planned and carried out and the capital expended. I thought that your first question applied to the annual expenditure.

907. Have you seen the scheme as drawn up by Mr. Bailey Denton called the Lee Valley and Ham Marshes Sewage Bill?—No.

908. How many lock-keepers have you at present? Have you a resident lock-keeper at each lock?—Yes, on the average we have quite one per mile.

909. I assume that the whole of their time is not occupied in the duty of lock-keeping?—Pretty much so; the work is too much for them to get away much from the lock.

910. Do you know how your income and expenditure balance at the present time?—I think that perhaps the clerk will answer that question better than I can, but they balance very fairly. On the whole we do very well. The trade very much increases.

911. Do you regulate your rates in proportion to your income, or are they fixed?—We should regulate them according to the income. We have practically a fixed amount, and if we find ourselves short of money, we try to economise in our work for a year, and not to do so much. Ever since I have had to do with the river we have always been improving, putting substantial works instead of old ones.

912. Is there anything which you think you can add to the evidence which you have so kindly given to us?—I may mention that the East London Company have deposited plans in the last month for diverting the future drainage from Waltham, Cheshunt, &c. I have not had an opportunity of seeing those plans, or knowing anything about them, but they would touch the question of the general conservancy of the river, and so on, and perhaps rather increase the desirability of having something done.

913. That question will come before Parliamentary Committees in the next session?—Yes.

914. Is there anything further which you would wish to add?—Nothing occurs to me now. I shall be most happy to state anything afterwards, if it should occur to me.

915. Are you also engineer for the New River?—No. I may say that the New River Company last year called upon the Trustees to execute a new work near Hertford in order to get the water better to London, and that was paid for by them in addition to the 30,000*l*., and that is one of the works which either they or the East London Company could call upon the Trustees to execute under the powers in the Act of 1855.

The witness withdrew.

LONDON.

N. Beardmore, Esq.

11 Dec. 1866.

APPENDIX No. 1 to the Evidence of N. Beardmore, Esq., C.E.

Rainfall at Feilde's Weir, Herts.—(Height above Sea, 90 feet).

Extract from Manual of Hydrology, by Nathaniel Beardmore, Esq., Civil Engineer, (referred to supra, Question 701).

Years.	1850.	1851.	1852.	1853.	1854.	1855.	1856.	1857.	1858.	1859.	Mean of 10 years.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
January	3·2	3·5	4·6	3·4	1·7	0·5	2·3	3·5	1·0	1·3	2·5
February	0·8	1·0	1·5	1·4	0·9	1·0	1·3	0·2	1·8	1·4	1·1
March	0·2	4·1	0·3	1·7	0·5	1·8	1·0	1·6	0·7	2·0	1·4
April	3·0	1·8	1·6	2·8	0·7	0·2	2·0	2·3	2·8	2·4	1·9
May	2·3	0 6	1·8	2·5	3·4	2·4	3·6	1·3	2·6	1·1	2·2
June	0·8	1·4	3·2	3·0	0·8	1·2	0·7	1·6	0·9	3·2	1·7
July	3·2	3·3	2·7	4·0	1·5	5·3	2·2	1·5	3·3	3·2	3·0
August	1·3	2·1	3·7	2·4	1·9	2·0	2·6	2·2	2·9	2·2	2·3
September	2·0	0·6	4·0	1·5	0·6	1·8	2·8	3·8	1·1	3·7	2·2
October	1·8	1·8	6·0	3·8	2·4	5·2	1·9	5·1	1·4	2·7	3·2
November	1·8	1·1	7·8	1·8	1·6	1·9	1·4	1·6	0·6	3·1	2·3
December	1·9	0·6	2·3	0·4	1·9	1·7	2·5	0·7	1·7	2·9	1·7
Total	22·3	21·9	39·5	28·7	17·9	25·0	24·3	25·4	20·8	29·2	25·5
Mean of 5 years	26·1					24·9					
Winter	7·8	8·2	7·8	14·9	4·1	5·0	7·2	7·6	5·1	5·0	7·4
Mean of 5 years	8·7					6·0					
Spring	6·3	7·9	6·9	10·0	5·4	5·6	7·3	6·8	7·0	8·7	7·2
Mean of 5 years	7·3					7·1					
Summer	8·3	7·8	16·4	11·7	6·4	14·3	9·5	12·6	8·7	11·8	10·8
Mean of 5 years	10·1					11·4					

Years.	1860.	1861.	1862.	1863.	1864.	1865.	1866.	Mean of 7 Years.
	in.	in.	in.	in.	in.	in.	in.	in.
January	3·40	0·85	2·15	3·50	0·95	4·00	3·90	2·68
February	1·50	2·35	0·38	0·70	1·20	1·95	4·05	1·73
March	2·60	3·10	3·42	0·85	2·72	1·40	1·90	2·28
April	1·30	1·28	2·60	0·80	0·73	0·28	1·95	1·28
May	4·30	1·40	2·80	1·00	2·40	2·40	1·70	2·29
June	5·60	1·95	2·30	3·94	1·55	1·90	3·20	2·92
July	2·00	2·00	1·32	0·78	1·00	3·05	1·95	1·73
August	4·05	0·55	2·65	1·85	0·95	3·56	2·20	2·26
September	2·70	0·80	1·50	3·05	2·23	0·60	4·40	2.08
October	1·70	0·90	3·45	2·10	1·05	5·40	2·55	2·45
November	2·60	4·60	1·40	2·05	2·50	2·35	1·95	2·49
December	2·00	1·20	1·78	1·35	0·60	1·90	2·50	1·62
Total	33·75	20·98	25·75	21·97	17·88	28·79	32·25	25·81
Mean of 7 years	25·81							
Winter	10·90	7·80	8·33	7·38	5·55	9·05	12·20	
Mean of 7 years	8·74							
Spring	13·80	7·33	11·12	6·59	7·40	5·98	8·75	
Mean of 7 years	8·75							
Summer	10·45	4·25	8·92	7·78	5·23	12·61	11·10	
Mean of 7 years	8·62							

LONDON.

N. Beardmore, Esq.

11 Dec. 1866.

APPENDIX No. 2 to the Evidence of N. BEARDMORE, Esq., C.E.

RIVER LEE, HERTFORDSHIRE. DISCHARGE OF THE VALLEY AT FEILDE'S WEIR (including all water taken into the New River above that place).

Drainage area 444 square miles; height of district from 80 feet to 500 above the sea; mean 240 feet. Length of main river 31 miles, of tributaries 92 miles above the weir; which is above 20 miles from the Thames at Blackwall.

Extract from "Manual of Hydrology," by Nathaniel Beardmore, Esq., Civil Engineer (referred to supra, Question 704).

Year 1851.

Month.	Mean temperature at Greenwich.	Rainfall.			Discharge over Feilde's Weir.			Discharge per square Mile.	Depth run off district.	Proportion of depth run off to depth fallen.
		No. of days.	Maximum day's rain.	Total.	Maximum.	Minimum.	Mean.			
	Deg. Fah.		In.	In.	Cubic feet. per min.	Cubic feet. per min.	Cubic feet. per min.	Cubic feet. per min.	In.	1 to
January -	42·9	18	1·10	3·65	83,080	7,227	23,198	52·2	1·04	3·51
February -	40·1	12	0·40	0·90	29,641	10,367	14,868	33·5	0·58	1·55
March -	42·6	20	1·22	4·35	95,677	9,448	28,582	64·5	1·24	3·51
April -	44·7	14	0·56	1·80	38,565	11,384	15,682	35·3	0·66	2·73
May -	50·9	10	0·30	0·76	21,216	8,887	11,207	25·2	0·48	1·58
June -	58·9	11	0·50	1·45	11,217	6,455	8,678	19·5	0·36	4·03
July -	60·1	16	1·55	2·92	10,930	6,235	8,000	18·0	0·30	9·73
August -	62·3	8	1·05	2·33	8,562	5,569	6,894	15·5	0·30	7·77
September	56·9	9	0·36	0·63	6,669	4,508	5,814	13·0	0·24	2·63
October -	52·6	12	0·45	2·15	8,108	4,473	6,260	14·1	0·27	7·96
November	37·9	10	0·40	1·10	7,342	4,753	6,290	14·2	0·26	4·23
December	40·4	6	0·50	0·58	8,126	4,660	6,127	13·8	0·27	2·15
	49·2	146	1·55	22·62	95,677	4,473	11,800	26·6	6·00	4·26

Year 1852.

January -	42·0	16	2·20	4·67	79,469	5,260	19,912	44·8	0·86	5·43
February -	40·8	10	0·60	1·48	40,957	9,305	14,575	32·8	0·59	2·51
March -	41·3	3	0·30	0·35	9,880	6,158	8,065	18·2	0·35	1·00
April -	45·9	2	0·56	0·94	8,226	5,102	6,722	15·1	0·28	3·36
May -	51·5	12	0·48	1·76	7,571	4,865	6,429	14·5	0·28	6·28
June -	56·1	21	1·02	4·35	44,695	4,929	9,804	22·1	0·41	10·60
July -	66·6	4	1·03	3·15	14,436	4,760	6,432	14·5	0·28	11·25
August -	62·1	15	0·65	4·08	29,098	4,890	9,717	21·9	0·42	9·71
September	56·8	13	1·20	4·02	63,214	5,405	13,823	31·1	0·58	6·93
October -	47·9	15	1·60	5·22	91,744	9,011	27,614	62·2	1·19	4·39
November*	48·9	22	1·80	7·30	106,795	18,699	55,341	124·6	2·32	3·15
December-	47·6	19	0·55	2·39	66,707	23,323	36,273	81·7	1·57	1·53
	50·6	152	1·80	39·71	106,795	4,760	17,892	40·3	9·13	4·35

Year 1856.

January -	39·4	18	0·55	2·35	69,428	9,225	24,345	54·8	1·05	2·24
February -	42·0	10	0·45	1·30	60,420	10,060	16,829	37·9	0·68	1·91
March -	38·7	6	0·70	1·00	15,167	8,669	10,246	23·1	0·44	2·27
April -	46·8	13	0·60	2·00	22,935	7,555	9,944	22·4	0·42	4·76
May -	49·5	18	0·77	3·60	47,031	7,533	12,235	27·5	0·53	6·80
June -	55·2	7	0·30	0·65	13,963	7,399	9,264	20·9	0·39	1·66
July -	61·1	13	0·72	2·25	8,792	6,009	7,529	16·9	0·32	7·03
August -	63·6	10	0·80	2·60	6,047	5,266	5,759	13·0	0·25	10·40
September	55·2	7	1·05	2·80	11,312	4,119	5,851	13·2	0·24	11·66
October -	51·7	10	0·25	1·90	12,030	4,958	6,634	14·9	0·29	6·55
November	40·7	10	0·40	1·40	20,056	5,969	7,849	17·7	0·33	4·24
December-	40·2	12	0·40	2·05	64,902	6,242	14,500	32·6	0·63	3·25
	48·7	134	1·05	23·91	69,428	4,119	10,915	24·6	5·57	4·29

Furnished by Nathaniel Beardmore, Esq., Civil Engineer (referred to supra, Question 704).

Year 1858.

January -	—	8	·20	1·00	12,396	7,101	9,932	22·37	·43	2·32
February -	—	7	·50	1·80	92,383	9,470	18,718	42·16	·73	2·47
March -	—	9	·14	·75	14,466	6,748	10,046	22·63	·49	1·58
April -	—	8	·80	2·80	82,869	7,429	14,282	32·17	·60	4·67
May -	—	16	1·45	2·60	32,568	6,527	10,268	23·12	·44	5·91
June -	—	5	·50	·88	9,620	5,753	7,169	16·15	·30	2·93
July -	—	14	·70	3·30	9,628	5,199	7,100	16·00	·31	10·64
August -	—	10	·90	2·90	7,632	4,387	5,734	12·91	·25	11·20
September	—	11	·20	1·05	7,250	3,107	5,116	11·52	·21	5·00
October -	—	12	·28	1·43	6,088	3,586	4,874	10·98	·21	6·81
November	—	8	·18	·60	5,665	3,546	4,746	10·69	·20	3·00
December	—	16	·42	1·75	9,058	4,121	5,392	12·14	·22	7·60
	—	124	1·45	20·86	92,383	3,107	8,614	19·40	4·39	4·74

* This month had the heaviest floods known all over the Eastern Counties, and basin of the Thames; they happened during the week of the funeral of the Duke of Wellington, and the flood is generally called after his name in consequence.

LONDON.

Mr. C. Greaves.

11 Dec. 1866.

Mr. Charles Greaves (London) further examined.

916. (*Chairman.*) Have you anything to add to your former evidence?—There are one or two points which you asked about yesterday. I was asked the proportion of houses having watercloset arrangements. I am not able to furnish that information at all distinctly as to the whole district, because we have not before in going through our district counted up that particular distinction of closet fittings and no closet fittings, but in a survey which is at present in progress I have it partially done. I can give you an enumeration of two districts; in one or them out of 5,938 houses, 4,509 have closets and water supply fittings to the closets; in the other case 8,474 houses include 4,611 closets.

917. Do you think that those would be fair average proportions for the whole of your 90,000 houses?—I do not see why the proportion of the whole should differ from that, it is a large proportion.

918. (*Mr. Harrison.*) It is very nearly a closet for a house?—In the first case there is a larger proportion of closets than the second.

919. (*Chairman.*) Is there any other documentary evidence which you have to give?—I am not prepared with anything else.

920. (*Mr. Harrison.*) We have had evidence from Mr. Beardmore this morning as to the point to which the spring and the neap tides rise in the river. The difference of height he mentioned as being about 3 feet 6 between the ordinary spring tides and the ordinary neap tides, is that about correct?—I should think so.

921. He also stated that he thought that the banks exposed to the action of the sun during the neap tides would be about 8 acres; those are the banks at the tidal portion of the Lee?—That is a point upon which I can hardly make an estimate.

922. Do you think that it so much as that?—I should think quite that, because a very narrow strip over several miles of river would make eight acres.

923. Mr. Beardmore also mentioned that there was a considerable deposit upon that area so exposed, and that there was a considerable effluvium arising from it during the hot season and during neap tides, causing a nuisance in the neighbourhood?—There is no doubt that in hot summer weather the smell from the river is at times dreadfully offensive, but how to distinguish between the smell from the water itself and the smell from the banks is perhaps a fanciful thing to assert.

924. Is the smell as great when the tide is in at a full spring as at other times?—No.

925. Mr. Beardmore also stated that that nuisance had increased since the execution of the metropolitan sewerage?—Since the imperfect development of the main drainage.

926. Do you think there is a point up to which it attained a maximum, and that it has been diminishing since then?—Decidedly; because the public outcry throughout the whole of the eastern district against the discharge which was taking place from the unfinished main drainage system was sufficient to induce the metropolitan board to put up temporary pumping engines, by which the evil on that account was very much diminished, and they are now lifting a very large proportion of the low level sewage into the main drainage pumping station.

927. Are your old reservoirs on the banks of the tidal portion of the Lee?—They are.

928. And they are within the influence of this area so exposed during the neap tides?—Yes.

929. For what length of time has the water been stagnant in those old reservoirs?—We call them the uncovered reservoirs; I should say since they were disused, which is since 1855.

930. The water has not been replaced by a fresh supply?—Only in a small way, not by any emptying and filling again, or anything of that kind.

931. From whence do they receive the supply to replace evaporation?—At present they have neither inlet nor outlet; but, as I described in my evidence yesterday, they were connected with the disused canal coming down to Lee Bridge, and if they lost more than we could otherwise supply it was within our power to fill them up again from that source if they did not get filled by the overflow from the filtered water aperture.

932. Do you think that those reservoirs adjoining the Lee, and subject for that number of years to the gases arising from the waters of the Lee, would imbibe a portion of those gases, and would become foul from that cause?—I never thought so, nor is there any evidence that they are so excessively foul. No doubt the deposit in the bottom is not so sweet and clean as the water in the upper part, but they are generally bright, and sometimes very bright.

933. Do they vary in appearance at the surface?—Sometimes they are a little cloudy, and sometimes they are excessively bright, because warm weather will cause water to become cloudy by producing vegetation in it.

934. In your opinion does the brightness of the water at all determine the purity of the water?—Not altogether.

935. (*Chairman.*) I think that Mr. Harrison has put the question whether the evaporations and the emanations from the surface in the spring of this very year were not very foul through the open ditches, the open cuts, the open river, the mud banks, and in the case of all the surface evaporations in that district, which give off foul gases?—I do not know that that state of things was particularly prevalent in the spring of this year, but the discharge of sewage from the incomplete main drainage works reached the culminating point in this year, and the local member of the metropolitan board strenuously urged the damage which this was doing to general health, and induced that board to establish a pumping engine to lift the sewage from the special low level branch sewer which takes up the Hackney district, anticipating what will be done for the whole of the low level sewer when the pumping station is complete.

936. How long does your filtered water remain in the low-water reservoir as a rule before it is used? If it is filtered to-day is it in the services on the same day; have you not a very large storage of pure water?—No, but I do not withdraw from the storage which I have, more than one-third of its depth on any day. I am not speaking exactly to figures, but that is nearly about the proportion.

937. Are you pumping the fresh filtered water as it is filled?—No, the pure water reservoir holds three times what is taken out of it in the course of a day.

938. Is that the upper or the lower pure-water reservoir?—I am speaking of the Old Ford covered reservoir, it holds three times what I draw out of it in the course of a day, the one third which I draw out I fill up again in the course of the following night, and therefore, it is as if you took a bottle and drew out one third of its quantity and filled it up again.

939. Then very little of that water is exposed to the evaporations, contaminations, and deleterious influences of which we have been speaking?—Very little; I should say that there is no contamination.

940. If you have an open reservoir of several acres in which the water, however bright, has been standing for several weeks, that water has been exposed very much longer than the other water to any deteriorating influences, if they have any action upon water?—Decidedly, that is clear.

941. Do you know chemically that water has a powerful affinity for various gases?—Yes.

942. And that a very bright sparkling water may surcharge itself to a very great extent with gases?—Yes.

943. Ammonia for instance?—Yes.

944. It may absorb many times its own volume, that is to say, that a cubic foot of water may absorb many feet of ammonia gas?—I am aware that the quantity is large.

945. You are aware that in a soda-water bottle the gas is in volume many times the quantity of the water in the bottle, it being under pressure?—Yes.

946. Then it is possible that the water in the open reservoirs, although apparently bright, may be in a very different condition to the water supplied to your customers?—Yes.

947. (*Mr. Harrison.*) In consequence of the length of time that it has been stagnant in the river Lee?—I think that that is a fair conclusion.

948. You mentioned to us yesterday that you had known a case where gas had mixed itself with the water supply?—There was a sort of inhaling of the gas just by the fracture of both gas pipe and water pipe. The water running away drew the bulk of the gas into the pipe. The two pipes were broken and the breaks were near one another, and as the water-pipe emptied itself by the water running away it filled itself with gas, then the supply of water coming in at the other end pushed the gas forward and made it burn at the tap.

949. Considering your intermittent system of water supply is not such an accident as the fracture of a gas pipe, and a leakage into your water pipe, a case likely to occur?—It is so rare that it could not be considered as one of the accidents to which pipes are liable.

950. You have put in a number of reports for the last few months. At page 277 there is this observation, "One of these reservoirs was recently emptied and was "filled again. These old reservoirs are not used, the "covered reservoirs containing the only water fit for "use." Can you say whether or not there is any truth in that statement?—There is no question that the larger of the two uncovered reservoirs was emptied by special steam power into the Pudding Mill stream.

951. When was that?—At the beginning of this year, in the spring, when we had under consideration an abandoned notion of extending the covered reservoirs at Old Ford.

952. How was that reservoir filled again?—Partly by rain, and partly by the leakage from the adjoining reservoir, which was full.

953. Can the water soak from the adjoining reservoir into this reservoir?—It appears that it did. The northern reservoir was full, and the southern reservoir was empty.

954. How far were they apart?—Only about the breadth of this room, and there was no substantial barrier between them; in fact, only one, which having been damaged, it had not been thought necessary to repair.

955. Did you observe at the time how the reservoir was filled again?—I stated that opinion myself to Dr. Frankland, not exactly in those words, but that it had acquired water again by rainfall and by soakage from the adjoining reservoir.

956. What period did it take?—Some weeks. We never had it full. There has been more made of the fact than was right, but there is no question that the bottom of that reservoir is not tight.

957. What is the subsoil under that reservoir?—More gravel than anything else.

958. In a case of that sort there is a communication between that gravel and the reservoir, so that the reservoir can be filled from the gravel below it?—I suppose so.

959. Does that gravel bed pass under the river Lee adjoining?—I do not quite know where the division of the strata takes place, but there is a considerable difference in the character of the sub-strata on the line of the river there.

960. What is the level of the water in the open reservoir when full, as compared with high-water in the river Lee?—I should think that it was rather above Trinity, but tides of course rise above Trinity.

961. Then do you think that the water in the reservoir would be nearly level with spring tide Trinity?—Yes.

962. What is the depth of the reservoir?—It is 10 feet deep.

963. Then might not the leakage be from the river as well as from the adjoining reservoir?—When water rises in a soil which is permeable, it is of course difficult to say where it comes from.

964. The point from which you take your supply I think is some distance above the tidal influence altogether?—A long way, not only in distance, but in height. There are two locks, and two mill-falls between.

965. You are now, I think, authorized to take 23,000,000 gallons a day?—That is not the proper definition of the quantity which we are authorized to take.

966. Is that about it?—No, I cannot say that it is. The New River Company are entitled to take 2,500 cubic feet a minute at the first cut out of the river up at Hertford; then the East London Company are entitled to take a similar quantity. That is the way in which the priority stands. We hold the whole river. The river is committed to us, barring a certain quantity which is given to the Trustees for the purposes of navigation only. We divide the river between us, but there is a certain priority which has arisen out of the old standing of the New River Company, and their better position as to level, being higher up the river.

967. At present you have about 20,400,000 gallons, that is, of clean water in fact?—Yes.

968. Mr. Beardmore has said that you take your supply from the river proper, and not from the canal?—Yes.

969. You mentioned yesterday that the water is carried in a channel of 100 square feet down to the settling reservoirs?—Yes.

970. How frequently is the channel cleared out?—Two or three times in a year.

971. Is the water let off, and is the mud cleaned out?—We get it out pretty clean, but we send it forward; we open the sluice and send it down.

972. You send it into the river Lee below?—Yes.

973. Then you get it clean in that way?—We wash out all the mud, and we can get it cleaner in that way than in almost any other possible way.

974, How many settling reservoirs have you into which the water from that channel is conducted?—The whole area of the reservoirs which may be called settling, or storage reservoirs, is divided into fiv

975. So that you can cleanse each of them alternately?—I could do so, but they are of recent construction, and their cleansing is not a point which has become necessary yet; they could not be emptied without steam power.

976. Can you empty one part of this storage area and leave the remainder?—The five I could empty in three sections.

977. And you could leave the others in action?—Yes, not precisely, but to some extent I think. Reservoirs of that kind acquire a very small amount of sediment on the bottom.

978. How many years have they been in operation?—Only since 1863.

979. Have you any knowledge of the deposit which now exists?—There is no appreciable measurement of it.

980. Do you find any effects during hot weather, or during a change of weather from the condition of the water arising from that deposit?—Not arising from the deposit.

981. Do you find any effects from any circumstances?—The water changes its appearance and character on the surface, with changes of weather. It has at times an apparent tendency to vegetation in the warm weather; you see something preparing to start into life upon the surface.

982. What do you think that that arises from?—It is very difficult to trace the progress of these seeds of vegetation, or where they start from, or how they are disseminated.

983. Do you find that as the summer advances that vegetation disappears or increases?—That is the green weed which Mr. Harrison was speaking of yesterday. It acquires a full development and then disappears.

984. Where does it go?—It sinks down and goes away, and it becomes diminished in magnitude. All these water weeds are of very small body, and after

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Mr. C. Greaves.

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they have ripened into full vegetation they seem to be gone until the next season.

985. Would not the deposit in those reservoirs be to a great extent sewage matter?—No, it would be weed, and clay and fine silica.

986. Did you ever clean out any of your reservoirs so as to ascertain that point?—It is mostly of a mineral character. The basins which we have been talking of as the covered basins were cleaned out thoroughly before they were covered. There was a great deal of mud in them then, but there was nothing particularly offensive in it. Of course, mud has always a bad name, and no doubt it had a certain amount of vegetable matter in it, but it was mostly fine clay and chalk and silica.

987. I think that you stated yesterday to the chairman that you could not tell exactly what volume of water the filter-beds would pass through them per square yard, or per hundred square yards, and that the quantity passing varied at different times according to the condition of the water?—According to the condition of the water and to the condition of the beds.

988. You said that sometimes the water in the filter-beds was very nearly level, and that at other times there was a considerable difference in level?—The more you choke the surface of the beds at times of course the more retentive they are, and the difference of level increases.

989. Do you find that at different periods of the year that difference is very marked?—Yes.

990. When do you find the filter-beds acting worst?—The two periods which give most trouble are, one due to excessive vegetation in the commencement of the summer, and the other due to an excessive deposit of clay in the winter. I cannot draw a comparison between the two.

991. Have you ever on any occasion such an obstruction arising from those causes as to prevent your filtering arrangements being carried out satisfactorily?—Never such as to prevent their being carried out, but certainly to prevent their being carried out satisfactorily. We have had to clean filter-beds on the Sunday, and to do things of that sort, but it never went to such an extent as to interrupt the filtering.

992. The water from the filter-beds passes covered into the tanks, both of the upper and of the lower pumping stations?—Yes.

993. So that evidently the water which you pump from those sources in each case would be identical?—Yes.

994. Are there any means of pumping water from the open reservoirs at the upper stations?—No.

995. There is no communication between your pumps and the upper reservoirs?—No communication.

996. Have you any wells from which you draw water at all?—We have a chalk bore which we have not yet put into use.

997. At the lower pumping engines have you any wells?—None at all.

998. Have you a communication with the closed tank, the one which is now stopped, the uncovered reservoir?—Yes.

999. In saying that your Waterworks Acts are properly carried out, is there any Government inspector, or any person authorized to look into the matter, and to to see that the conditions of the Acts are fulfilled?—None beyond what is on your table.

1000. You have obtained certain powers, and you have carried out those powers?—Yes, an inspection was made by order of the Board of Trade, and Mr. Austin, Mr. Ranger, and Mr. Dickens came down.

1001. That was a special case?—Yes, there is no continuous examination.

1002. In supplying the tenements in the district which you supply with water, what is the size of the tap from which the persons in each tenement can draw?—Half an inch for constant supply as a general practice, and three-quarters for daily supply.

1003. Have you observed what quantity of water per minute or per hour can be drawn from a three-quarter-inch tap under the pressure which you apply in different parts of your district?—I cannot give it to you in gallons, but it is a matter of common daily experience with the subordinate officers of the company. In all waterworks certain pipes are sufficient for the supply as required.

1004. What quantity of water would a pipe three-quarter-inch bore deliver at the highest and lowest point of your delivery, when the supply is intermittent?—I do not think that it could be given in any figure, because the length and position of the pipe are various; a three-quarter-inch pipe is ample.

1005. Supposing that it is pretty close to your main, what quantity of water per minute will a three-quarter-inch pipe deliver with the pressure which you maintain; I understand that you maintain a constant pressure?—We maintain a constant pressure, but the pressure and flow do not always match one another.

1006. Do you not think that it is a point of importance to you to know what quantity of water a three-quarter-inch pipe will deliver at any point?—It is difficult to know it with precision in the different cases which arise. We know that a three-quarter-inch pipe and a half-inch pipe are more than enough.

1007. Cannot you give any figures as to the discharge from a three-quarter-inch pipe in your district under the pressure which you apply?—I may have had them, but I have not them by me; they are not figures of any value so as for me to keep them.

1008. For what period in the day do you supply water to the tenements under the intermittent system?—The average is about 20 minutes.

1009. I observe that in these reports there are two districts mentioned, in one of which the period is 10 minutes, and in the other it is 15 minutes?—Yes.

1010. And complaints are made of the shortness of that time?—Yes.

1011. Complaints are made to the medical officers of the two districts?—Yes, that is one of the difficulties. There are hundreds and thousands of cases in which houses could get their supply in 10 minutes, but we are obliged to give it to longer than the 10 minutes, because they are not prepared to receive it.

1012. What notice is given to the people occupying these premises that the water is going to be turned on?—It is a uniform period every day.

1013. So that the people know exactly when the water is coming?—They ought to be prepared; there is no excuse for not knowing.

1014. As the time is so limited it is of great importance that the quantity of water which can be discharged in the time should be well known?—Quite so, but it is now practically known.

1015. May there not be some persons who are so engaged that they cannot afford to obtain a supply?—I have no doubt that there are cases in that position, but if the water company are to give way to case after case of that kind they may give up altogether.

1016. Have you any poor districts where the supply is constant?—Yes, very large districts.

1017. What amount do you find practically that they take per head per day in such districts?—I myself am not indisposed to a constant supply, and I believe that if a more arbitrary power could be given for carrying out a constant supply, and if that power was exercised, a constant supply would be no more distressing to the water company than an intermittent supply.

1018. What quantity do they actually take in a poor district where there is a constant supply?—It varies, I suppose, from 60 to 120 gallons per house per day.

1019. For how many people would that be?—Taking our district through, I believe that the population is about eight to a house.

1020. So that it would be from 10 to 15 gallons a head?—Yes.

1021. The poor would take considerably more than the rich?—I suppose not, because the way in which the greater quantity of the water goes is by the water-closet arrangement. One of our great difficulties throughout the poorer and inferior districts is the difficulty of having fittings in the houses competent to receive the water. We know that the proportion of houses having nothing better than an 18 gallon tub amounts to 20 or 25 per cent of the whole population.

1022. I asked you yesterday as to the number of pumps and wells in the district which you supply; you could not give me any exact information upon the subject, but I found last night that there were reports upon the subject to the Registrar-General, and among others, there is one from Dr. Letheby who reports that the districts in which he acts include the City, East London, and West London, and that there are 35 pumps in the city; and he gives the quantity of organic matter, which is very much larger than either that from your company or from the New River Company?—Yes; those are public pumps I imagine, which had been erected as charitable erections in former years, and they stand by cab stands and kerbs of the pavement.

1023. He says that in most cases the constituents are remarkably indicative of the source and nature of the pollution, he seems to say that they are very polluted?—None of the old sewers were made with tight bottoms, and therefore the pumps and other things must draw water which is polluted.

1024. Besides Dr. Letheby's reports there are the reports of the Registrar-General in August and September 1866, which mention the number of pumps and wells. There is a report from Dr. Adams, the medical officer of health for Shoreditch; he says, "I have long "taken pains to suppress pumps and wells, and I "believe that the company's water is now almost ex-"clusively used." Dr. Liddle the medical officer of the board of health for Whitechapel, states, "I have had no "experience as to the effects upon health from pump "water, but the water from many of the pumps "recently became so foul that it was deemed advisable "to prevent the further use of them"?—Yes; we have had that information from time to time.

1025. Mr. Orton, the medical officer of Limehouse, states, "There are no public wells in use;" Dr. Woodforde, of Bow, says, "We have neither pumps, wells, "nor springs in use for the supply of drinking water." The medical officer of Poplar states, "There are not "any pumps or wells in my district"?—That I suppose means public pumps.

1026. There would not appear to be any great number of pumps or wells within the district, and those which there are appear to be very bad?—Yes.

1027. Do you know the quantity of water which is daily taken by the five water companies from the river Thames?—It is stated in the monthly reports.

1028. It is 48,375,000 gallons, and the two water companies take from the Lee about 43,300,000 gallons?—Yes.

1029. So that from the river Lee you take very nearly as much as is taken from the Thames?—Yes.

1030. The area of the Thames above the point of water supply is how many square miles?—I should think about 3,500.

1031. And the area of the Lee above your water supply is what?—It is about 450 or rather more; it is not more, taking into consideration the excluded district.

1032. So that the volume in your case is taken from a much less total area, although your take is nearly as much as a whole?—Yes.

1033. Can you state the volume of water taken from the Lee in 1850 by the New River Company and by the East London Company, as compared with what it is now in 1866?—I do not think that I can state the New River quantity in 1850; the East London quantity was about 11,000,000 gallons a day.

1034. And at present it is what?—Nearly 20,000,000 gallons.

1035. I believe that in 1850 the New River Company had 12,000,000 gallons from the river, and now take about 16,000,000 gallons directly from the river?—Yes; and all that they took from springs would have gone into the river.

1036. So that the amount taken direct from the river was in 1850, 22,000,000 gallons; and is now about 37,000,000 gallons?—Yes, altogether.

1037. Have you an intimate knowledge of the district of Poplar and that neighbourhood?—I think so; I am well acquainted with the whole district.

1038. Were you acquainted with the condition of the sewerage of that district from the commencement of this year and until Midsummer?—There is no doubt that the sewerage of that district was in a very imperfect condition.

1039. Was the lower level sewer of the metropolitan drainage being carried out through that district?—Yes.

1040. It was not completed?—It is not completed yet.

1041. Was the sewerage of that low-lying district up to a recent period improved as compared with former years?—Quite unimproved, and in fact I should think that it would be a very fair thing to say that it was very much deteriorated, because by the discharge which was taking place into the river Lee and passing down the river Lee by various channels, the atmosphere was tainted more than independently of that nuisance it would be. There is no doubt that that was an imported nuisance, it was brought down to that low-lying district.

1042. The sewer which has lately been formed through the district is part of the low level sewer?—Yes.

1043. (*Professor Way.*) Nothing has been discharged into that sewer from the upper district of London, has there?—We do not precisely know what has been done, but it is quite evident that more sewage has been turned into the Lee than would be turned into it in a natural way.

1044. Was that in overflow times when the mid-level and the low-level sewer were made?—It was not only in overflow times but at other times.

1045. The low-level sewer has not been made through London?—No.

1046. (*Mr. Harrison.*) Do you know that more sewage was brought down to this district on account of the partial completion of that low-level sewer than was due to the district itself?—I should say so.

1047. Has it had any influence in the Limehouse cut and that part of the river Lee?—It has had a decidedly damaging influence.

1048. At present a pumping engine is placed at the terminus and the sewage is being pumped into the high-level sewer?—A certain quantity of it.

1049. Is there anything which you wish to add?—I think not.

The witness withdrew.

LONDON.

Mr. J. Muir.

11 Dec. 1866.

Mr. James Muir (London) examined.

1050. (*Mr. Harrison.*) I believe that you are the engineer to the New River Company?—I am.

1051. That is one of the oldest established companies in existence?—It is.

1052. Whence does it derive its water supply?—It derives its water supply from the river Lee at a point between Hertford and Ware, and also from the Chadwell spring.

1053. Was the Chadwell spring its original source of supply?—It was.

1054. What volume of water does it deliver?—A varying volume, but the average is 400 cubic feet a minute.

1055. That would be 3,600,000 gallons a day?—Yes. Some gaugings which were made at the beginning of this year showed it to be very nearly 700 cubic feet a minute.

1056. That is 6,300,000 gallons a day?—Yes.

1057. What is the minimum flow which you have ever recorded?—The minimum which I have gauged is about 290 cubic feet a minute; that is a very rare occurrence indeed.

1058. When did you record the minimum?—I think that the minimum may be taken as having occurred in the year 1864.

1059. Was the quantity then less than in September 1865?—I think so, but I did not gauge it in September 1865; there was not the same reason for gauging then.

1060. You have not kept a periodical gauge at any time?—I have not.

1061. You also take water from the river Lee?—Yes.

1062. That is under an Act of Parliament?—Under an Act of Parliament, under which a quantity is now taken from the river Lee; it is the River Lee Act of 1855.

1063. What volume of water are you empowered by that Act to take daily?—It is stated in the Act to be 2,500 cubic feet a minute, and that is about 22,500,000 gallons a day.

1064. Do you take a volume to that extent?—No. Up to this day of this year I think that we have taken 18,000,000 gallons and a little over on an average.

1065. We understood Mr. Beardmore to say that that river is derived almost entirely from chalk spring water?—Yes; the drainage district is almost entirely chalk, and the water which it yields may be called spring water.

1066. Do you know the volume which passes down the river at the point at which you abstract the water?—I can only know it approximately by knowing what has been drawn through our own gauge, and by taking into account what the navigation may have used, and what may have been used by the mill in the immediate neighbourhood of us.

1067. And what is that?—I cannot give the average, but I think that the minimum is something rather less than 3,000 cubic feet a minute.

1068. That would be about 27,000,000 gallons a day?—Yes.

1069. What is the population within the drainage area above the point from which you take your supply?—The populations of Hertford and Luton amount to about 22,000; the population of Luton, from the census returns is, 15,329, and of Hertford 6,769.

1070. Are there any other large towns besides those two?—No.

1071. Are there villages to any extent?—Not to any great extent. I think that the most populous villages are on the river Rib and its tributary, the Quin; and I think that the population of that valley may be taken as about 7,187. These populations are taken at principal places on the tributaries. The population on the Lee, omitting Luton and Hertford, is 3,431; on the Mimram it is 2,212, and on the Beane it is 1,687.

1072. Making a total population above the point of supply of how many?—36,600, including Hertford, the drainage of which is carried below the Company's intake.

1073. You have not included Hatfield in that?—No, there is no direct drainage into the Lee from Hatfield, and in regard to Hertford and Luton I have kept them apart because they are dealt with by sewage works; the population not dealt with by sewage works is 14,500.

1074. Has Luton carried out a system of purification, or of irrigation?—Of purification.

1075. After the purification does the effluent water pass into the Lee?—It does.

1076. Have you had it examined as to its condition?—I have.

1077. What is its condition?—On some occasions its condition may be described as tolerably good; on other occasions complaints have been made at the instigation of the New River Company, some years ago. These complaints were brought before the Board of Health. The first complaints made issued in the town authorities carrying on this work of deodorization, and when the complaint was afterwards renewed they added to their works, and since the addition there has been no ground of complaint.

1078. As to the sewage of Hertford, have you yourselves taken steps to remove the sewage to a point below that at which you abstract your supply?—We have.

1079. And have you taken steps to deodorize that water before it passes into the river?—Yes.

1080. What are those steps?—They are described in the Hertford Sewage Act of 1854, in which it is enacted that the sewage after being collected shall be dealt with by Higgs's process, namely, precipitation by lime.

1081. (*Professor Way.*) The same as at Tottenham?—Yes.

1082. (*Mr. Harrison.*) Does the effluent water after that process pass in a pure state?—Yes, in a tolerably clear state. It is white from the application of the lime, and it is passed at a point below that at which the New River Company obtain their supply.

1083. Have you had that effluent water analyzed?—Yes. The sewage itself as it comes to the works is in a very diluted condition.

1084. Is that in consequence of the large introduction of spring water into the sewer?—Yes; the whole amount of suspended matter in the sewage is only about 6 grains and $\frac{3}{10}$ths per gallon.

1085. And what is the condition of the effluent water?—I cannot give that from the note which I have here. I must consult other memoranda.

1086. Perhaps you will give us an analysis of the water?—I will do so. (*The witness subsequently furnished copy of analysis, and it will be found printed at the end of his evidence, Appendix No.* 1.)

1087. Besides those two sources of supply, do you derive water from wells?—Yes.

1088. Where are they situated?—There is one well at Ware which has not been used for many years.

1089. Why did you cease using the water at that point?—One reason was that it was not required, and another reason was that it was supposed to affect wells in the town of Ware—wells in the gravel. Means have been taken to prevent that, and a bore is being carried down into the chalk so that it may not affect any portion of the town of Ware.

1090. To what depth have you sunk?—About 300 feet.

1091. Did you find water throughout the whole of that depth?—Yes, but all the gravel water is now shut out, it is cylindered to a considerable distance into the chalk.

1092. What is the diameter of your bore?—The well has a diameter of 7 feet at the top, reduced to 6 feet 6 in the lower cylinder. The bore is 2 feet in diameter.

1093. Do you know what supply that will give you?—About 2,500,000 gallons a day.

1094. What volume used you to draw from the wells before?—It is so long since we worked that well that I do not know what quantity it yielded. There is a second well at Amwell hill.

1095. Do you take water from it now?—Very occasionally.

1096. With what volume will that supply you?—2,458,876 gallons in 24 hours.

1097. You do not take it because it is not required?—Yes; it is merely a means to fall back upon.

1098. What are the other wells from which you obtain water?—There is a well at Chesthunt capable of yielding 699,972 gallons in the course of the day. There is another well at Hoddesdon, not yet finished, but I suppose that it will yield about 2,500,000 gallons a day from the experience of pumping which we have already had.

1099. Your experience is that the water passes into your sewer pretty freely; do you find that by pumping water in large quantities from those wells you get it at all contaminated by sewage matter?—Not at all.

1100. Is that from the depth?—Yes, and the distance. The water which enters the sewers is entirely water from the gravel.

1101. Do you now use any subsiding reservoirs and filters?—Yes, our subsiding reservoirs are in Stoke Newington.

1102. Of what extent are they?—Of about 40 acres.

1103. When were they constructed?—About 1832.

1104. Have you any filters adjoining them?—Yes.

1105. How long have they been in operation?—Since 1856.

1106. Have you had occasion at any time to clean out the subsiding reservoirs?—They were cleaned out about 10 years ago.

1107. How long was it previous to that that they were cleaned out?—I believe not from the time of their construction.

1108. How many years would that be?—From 1832.

1109. What depth of deposit did you find after that long period of subsidence?—I was not engineer-in-chief then, but Mr. Mylne was, and I have heard him say that it consisted chiefly of mineral matter, clay which had been brought down by the stream and deposited there.

1110. What was the depth of it?—It varied.

1111. Can you state the average?—I forget it. I should add that there are also subsiding reservoirs at Hornsey, and filtering beds in connexion with them.

1112. What is the extent of those filtering beds?—Two acres at Hornsey, 5 acres at Stoke Newington, and $2\frac{1}{4}$ acres at the New River head.

1113. Are those the whole of the reservoirs?—Those are all the filtering beds which we have, excepting what are in course of construction, and those will add 2 acres to the area which I have given.

1114. Have you large impounding reservoirs?—No, not in addition. We have the subsiding reservoirs, which I have described, 40 acres at Stoke Newington and about 8 acres at Hornsey.

1115. What volume of water will those two sets of reservoirs hold?—I do not know that I can give that off-hand. The depth is very varying, but I think about 15 feet is the average depth in one of the Stoke Newington reservoirs and about 12 feet in another, and the area is 40 acres.

1116. How many days' supply will they afford to the district which you supply with water?—If they were pumped, which we have not the means of doing, they would afford a supply for 10 days or a fortnight, but we use them only for the purpose of subsiding; they are drawn down for a few feet and then are filled again.

1117. Will you describe your filter beds?—They are made in the usual way with brick sides and a brick bottom, and covered with coarse gravel, a finer gravel thereon, and then from 2 to 3 feet of fine sand on the surface.

1118. What quantity of water per 100 square yards will those filters pass through per day?—By pumping hard in the wells, so as to reduce the level of the water much below the level in the bed, a very large volume can be got through, but it is a bad treatment of the bed; a proper pressure will deliver between 600 and 700 gallons per square yard in the course of the 24 hours. To deliver the requisite quantity two-thirds of our area would suffice.

1119. Do you find much deposit from your filter beds?—Not a great deal; the deposit is chiefly after heavy rains. Nothing is so troublesome as the growth of weed under a bright hot sun; that weed falls down upon the sand and stops it up; the bed is then run off and the surface scraped.

1120. Mr. Beardmore mentioned that the rivers from which you are supplied are very little subject to floods?—Very little indeed.

1121. So that there would not be much surface abrasion carried down?—Comparatively little. In comparing the amount of filtering area which the East London Company provide and the amount of filtering area which we find sufficient, I attribute the difference very much to that cause, namely, that we are not so much affected by flood or mud being brought into our beds as they are.

1122. They have a much larger area in proportion to the amount which they deliver than you have?—Yes, much larger. I am now constructing beds, making an additional area of two acres.

1123. (*Chairman.*) Would you think that a filter bed was being distressed if it filtered one gallon per square inch in the 24 hours?—That would represent a very high pressure. A great deal would depend upon the coarseness or fineness of the sand; coarse sand will allow filtration to take place rapidly, but it will not be nearly so effective.

1124. That would be about 1,326 gallons per square yard instead of 600?—Yes, that is just about double what I mentioned as the proper thing.

1125. In your filtering beds have you any animal charcoal?—No; that has been the subject of a good deal of anxious consideration, especially since the hint was thrown out last summer by Dr. Frankland that the company should proceed at once to use animal charcoal. I procured animal charcoal, sold at 15*l.* a ton, and I experimented with it, but I found the thing not immediately applicable whatever might be afterwards done with it; that was as bone black.

1126. In what form would the charcoal be as bone black?—Very much as ordinary charcoal.

1127. Do you think that that is not a case which Dr. Frankland ever contemplated?—I do not know; he spoke of it as bone black. I took his directions; I took what he recommended.

1128. (*Professor Way.*) It is the same as the sugar bakers would use?—Yes.

1129. (*Chairman.*) Have you made any experiments with it?—I made some small experiment at the time, but the result was not very satisfactory. I filtered through it without having any sand superimposed, and the rate of filtration was 41 times greater than that which we find a proper and suitable rate of filtration with sand.

1130. Do you not think that in the construction of the filter the best arrangement would be to let it come below the sand, and not to be influenced by the sand?—Precisely. I only made this experiment because we had filtering boxes recommended. I found that they could not be arranged for, and that that exceedingly rapid filtration was worse than useless. The material sold at 15*l.* a ton was so impure that I found that it added to the impurities of the water.

1131. (*Professor Way.*) That would be the failure of an attempt under pressure of time and circumstances?—Yes.

1132. Therefore that does not settle the matter definitely?—No. There is no doubt that animal charcoal is one of the best of purifiers, and would be effective if placed under sand, say 6 inches in thickness; but the cost of it would be very great; there is the removal of the sand, the putting down of 6 inches of charcoal,

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and the replacing the sand removed. I find that the cost to the New River Company would be about 94,000*l.*

1133. You have assumed a certain thickness of the charcoal over your filters?—Yes, under the sand; 6 inches.

1134. One element of the calculation would be the time that this charcoal would act?—Yes, it would become inert and would require to be taken out and reburnt.

1135. Is it a question of days or months, so far as you know?—We have not experience enough for me to say. We are now making inquiries upon that very subject. Dr. Frankland threw out a suggestion that it might last three or six months; six is his maximum period, and the expense of it would be a thing recurring every six months, and of course, enormous. As the water requiring to be purified is a very small amount of the company's supply we are in a difficulty. The water supplied for waterclosets and so on would have to be passed through the same expensive process.

1136. Still you have not by any means negatived the possibility of it?—No.

1137. And you think that it would be desirable to bear it in mind as a means of purification?—Yes.

1138. You are quite aware that the sand-filters, if they do anything in purifying the liquid water from the solid suspended matters, do not perform that process as as you would wish it to be performed?—If it is carefully conducted I think that the sand process takes out the whole of the suspended matter, but of course there are matters in chemical combination which it takes out imperfectly.

1139. Therefore it is highly desirable that an improvement should take place in the purification of water?—There is no great complaint to be made of organic impurity in the New River Company's supply. We have had two analyses every month, made specially by Dr. Letheby. It would seem to me that the average is hardly four-tenths of a grain of organic matter per gallon.

1140. You are aware that the analyses which have been made of waters of late years have gradually reduced the quantity of organic matter by greater manipulation?—Yes, I believe that there are some analyses, for instance, Dr. Frankland's, in which, are enumerated under the head of organic matter, things which are not actually organic matter. I think that there is a difference between his analyses and Dr. Letheby's on that account.

1141. You, I believe, claim that New River water is as pure or purer than the water from any other source in the district?—It comes from a chalk district, described to you to-day as supplying almost all spring water and we pour into it a very large volume of pure spring water, and the analyses of Dr. Frankland shows that the New River water is the purest water, so far as organic matter is concerned.

1142. (*Mr. Harrison.*) Is there much tendency to growth in the tributaries above the point where you derive your supply?—Yes, there are weeds, and I should rather call them beneficial than otherwise.

1143. Are they beneficial when they decay in the autumn?—No, not when they decay.

1144. Do you find a difference in the analysis of the water then as compared with other times?—The first difference in this year took place this month from the heavy rains.

1145. Bringing down decayed vegetable matter?—And mineral matter also.

1146. (*Professor Way.*) Do you know of any supply of water to London which would not be mixed more or less with hard water?—No, unless in the case of the supply from the Bagshot sands, which was proposed some years ago.

1147. That might be sufficient for drinking purposes?—Yes.

1148. Do you know the supply of water in Glasgow?—Yes.

1149. Should you prefer water in its ordinary state, as supplied to Glasgow, to the water of the New River?—I think not. I think that the water as supplied to London is a more tempting water as a beverage than the very soft water of Loch Katrine. There is no doubt that Loch Katrine water is pleasant for washing from its excessive softness, but I think that there are decided advantages in a water not so soft for drinking.

1150. I suppose that the quantity of water used for drinking purposes is extremely small as compared with the quantity of water used for washing purposes?—Yes.

1151. Do you not think that some advantage might be gained if you could get a water for drinking purpurposes less hard than the water of the Thames or the Lee, but still not so soft as the water of Loch Katrine?—I think that the hardness of the London water—namely, the Thames, the Lee, and the New River is very much reduced by boiling, and that it therefore cannot leave a great deal to be desired, and that the result said to attend the use of softer water is rather astonishing. The complaints which have been made as to the use of the harder water proceed to some extent upon a fallacy.

1152. Is all the water which is used for washing boiled?—No.

1153. Is a large proportion of it boiled; in scrubbing you cannot put your hands into boiling water?—No; the quantity of soap destroyed in washing will not be measured by the quantity of water in the basin in which you wash. Take a basin of cold water; the hands are washed. The quantity of water in that basin will not measure the quantity of soap destroyed by the process.

1154. Do not you think that that arises from the fact that it is hard water? You wash out of the basin when you have hard water and you wash in the basin when you have soft water?—A good deal is used merely to remove the lather which you have made.

1155. A soft water uses less soap than a hard water?—Yes, but the estimate made of the quantity of soap destroyed by the quantity of water used would be a fallacious one.

1156. Do you know Dr. Clarke's process for softening water?—Yes.

1157. Have you seen it tried on a large scale?—No.

1158. Have you seen it tried on an experimental scale?—Yes.

1159. I suppose you are aware that he can satisfactorily soften the Thames water from 14 or 15 degrees of hardness to three or four degrees?—Yes.

1160. Do you know that that process has been tried upon a very considerable body of water, and is in use at this moment?—I believe that it has, and I believe that a difficulty has been found in working with it, chiefly arising from the deposit in the pipes which convey this softened water. I believe that it is not merely the mechanical deposit of the fine chalk which the process throws off, but that crystalization takes place.

1161. Is it in use at North Woolwich?—It was, but I believe that it has been discontinued.

1162. What you describe would arise from the remains of the carbonate of lime, which had not gone out of solution?—I suppose so.

1163. Has the question of softening the water by Dr. Clarke's process come at all under the attention of your board?—It has been matter of conversation, but it has never been very distinctly before them, so as to be a subject of resolution.

1164. Can we ascertain the fact that the water does choke the pipes?—I understood that that was one of the difficulties in its use at Plumstead, but I have not seen it.

1165. Do you think that it is barely possible that the use of the lime process might do away with the necessity of filtration?—To a great extent, no doubt, it would be so.

1166. Where lime is used in the case of the sewage

at Hertford it saves the necessity of filtration?—A. Hertford the precipitation is followed up by filtration.

1167. You say that Mr. Higgs' process is carried out at Hertford?—Yes.

1168. He had the process at Tottenham?—Yes.

1169. Is that process continued still?—No, it is discontinued.

(*Mr. Beardmore.*) It is nine years since it was used.

1170. (*To Mr. Muir.*) Was there any difference in that process from the one which was usually known as the lime process?—I think not. The patent, of which we bought from Mr. Higgs the right of using, was simply for precipitation by lime. I found it necessary to add chloride of lime, which had a powerful effect in stopping vegetation.

1171. You know that the lime process has been used in many places without success?—It has.

1172. And that even where it has been most successful, and has had the most chance of success, such as at Leicester, where the tanks were made to stop the valuable material, and not merely to clarify the water, but to produce a satisfactory result, they are giving it up?—It is not a commercial success, but it is as good a process of deodorizing as we can well use.

1173. Short of application to the land?—Yes. This particular process is prescribed in the company's Act as the one which they are to use, or (it is added) the one considered best, and we must wait to know what is the best process in order to apply it.

1174. Have you had at all under consideration the application of sewage to land?—It has crossed my mind, but the directors have not taken up the matter. I consulted Dr. Letheby not very long ago as to the application of the sewage of Hertford, and he thought that we could not do better than carry on the lime precipitation. Dr. Letheby said that we could not do better than increase the quantity of lime which Mr. Higgs prescribed, and I make it now, I think, three times what Mr. Higgs in the first instance prescribed.

1175. (*Chairman.*) Have you any means by which you could test Dr. Clark's lime process upon any considerable volume of your water without putting you to large expense?—I think that it must be attended with considerable expense if applied to any of our reservoirs.

1176. I mean any temporary reservoir, such as 2,000 or 3,000 gallons?—That would be a matter easily done.

1177. You could make a small tank and lime it with a due proportion of caustic lime, and make the experiment yourself?—Quite well.

1178. And you could try it upon different characters of water; upon the water when it was turbid, and upon the water when it was at the brightest?—Quite well.

1179. (*Professor Way.*) Mr. Simpson, some years ago, made an experiment at the Chelsea waterworks on 1,000,000 gallons in one quantity?—Yes.

1180. The experiment was very beautiful and very successful?—Yes. The difficulty in practice is giving time for the settling of the very fine impalpable chalk.

1181. Suppose that it could be shown that that process would dispense with filtration?—Then I am told that there would be a deposit in the pipes.

1182. (*Chairman.*) What volume of water per day have your company at command for supply to customers?—I think that we have now at command, including the various wells which we fall back upon if there is necessity, some 35,000,000 gallons per day.

1183. What number of customers do you supply in your district?—We have now more than 112,000 houses supplied.

1184. Then you are supplying by far the larger portion of the metropolis as compared with any other company?—Yes.

1185. What volume are you now giving to those 112,000 houses?—I think this month about 22,500,000 gallons per day.

1186. Have you any idea how many of those houses have waterclosets?—A great proportion.

1187. Nearly the whole of them?—Yes, excepting the very poorest places. There may be courts without separate waterclosets.

1188. Is your district an essentially watercloset district?—Yes.

1189. What is the population?—It is nearly $7\frac{1}{2}$ per house.

1190. I think that the average for the whole of the metropolis is $8\frac{1}{2}$ per house?—I thought that it was hardly so high.

1191. Yours is you think $7\frac{1}{2}$?—Yes.

1192. What volume are you supplying for trade purposes?—It is difficult to say, because many trades are carried on in a small way in connexion with domestic consumption.

1193. When you supply for trade purposes do you supply by bargain or by meter?—In a great many cases by meter.

1194. What meter do you use?—Siemens's meter is the most convenient. I do not say that it is the most accurate, but it is very easily placed, and the customers do not object to it. They always object to a more accurate piston meter from its great bulk.

1195. Do you think that Siemens's meter is as fair to you as to the customer?—No.

1196. Would not Siemens's meter, if the supply was intermittent, register rather against the consumer than against the supplier?—I think not; but almost all our mains have constant supply where a meter is furnished.

1197. Have you any idea how many meters there are on that system?—There are 720 meters in use in the New River Company's district.

1198. You can also give about the average consumption?—Yes. Those meters together measure about 2,300,000 gallons a day on an average.

1199. What is the price?—It varies according to the scale of the Act of Parliament of 1852.

1200. Your Act of 1852 gives the scale?—Yes.

1201. Do you charge the maximum amount allowed in that scale?—Yes.

1202. Do you make any allowances?—We do in some cases.

1203. How many fire hydrants have you upon your services?—There have been some recently placed upon the mains in Cheapside for the purpose of washing the surface, but, generally speaking, all the fire supply is through the old plug. The cost of a plug, or the cost of a hydrant is a thing which by law should fall upon the parish. We have not required the comparatively inexpensive plug to be found by the parish, but we have found it ourselves, but the more expensive hydrant, costing 6*l.* or 7*l.*, the parishes or Metropolitan Board of Works must find.

1204. Is the water supply for fire gratuitous so far as you are concerned?—Quite.

1205. Do you supply any water gratuitously for baths, or hospitals, or fountains?—At reduced rates baths have been supplied, and practically you may say that there has been a cheaper supply to hospitals, though not nominally, for the full rent is put down, and the company make a donation.

1206. Do you supply any water by agreement or by meter, for ornamental purposes, in your district for fountains or for garden purposes?—Yes. We rather object to provide fountain supplies to parks and houses where the water may go to waste.

1207. You discourage it?—Yes.

1208. Would you discourage it if the supply was by meter?—We should not have the same objection then.

1209. Is a portion of the supply of your district intermittent?—Yes.

1210. What number out of the 112,000 houses which are supplied would be upon the constant system, and what number upon the intermittent one?—I think that only about 1,200 or 1,300 are now on a

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constant supply, and all the rest are on an intermittent supply.

1211. Is the intermittent supply on each day or on alternate days, or in what way?—Every house has a supply every working day in the week, and some of the houses have a Sunday supply.

1212. What is that supply?—It varies; but the rule is, that the supply in every case is to be left on by the turncock so as to fill the cistern, whatever it may be.

1213. In all cases are there cisterns or tubs for the intermittent supply to the poorer class of tenants?—In some of the poorest houses they have no tubs supplied by the landlords.

1214. Then if they miss the supply by being out, or anything of that sort, they miss the supply for that day?—Yes, or get it from some other place.

1215. Have you any byelaw which would enable you to prosecute a person for taking water otherwise than from the company's supply?—Yes.

1216. You would apply the term stealing to taking water without arrangement, or without paying for it?—Yes; that clause, I believe, is in the General Water-works Clauses Act.

1217. Have you any estimate as to what volume is supplied to those poor tenants, or is it merely haphazard?—We cannot separate that supply.

1218. (*Mr. Harrison.*) You have said that you keep it on in the different parts of your district a sufficient length of time to afford the requisite supply to each tenement?—Yes; in every case, it is found out what time is requisite to supply the cisterns in all the houses.

1219. What quantity will those cisterns hold?—It varies. One house in a street may have a large cistern, and the water is left on long enough to supply that cistern, and all the other houses get the benefit of it, whether they have such cisterns or not.

1220. Then the largest sized cistern governs the supply for the whole district?—Yes, if it is of a reasonable size.

1221. What should you call a reasonable size for the whole district?—From experiments which I made some years ago in model lodging-houses I found that their actual requirements, allowing them to take as much as they required, did not amount to more than seven gallons per head per day, but rather less; a great deal more than that is allowed them.

1222. (*Chairman.*) I presume that you are not responsible for the private arrangements and storage for domestic and other purposes in the case of the poor tenants?—Not in the least.

1223. Is it or is it not a fact within your knowledge that those arrangements in many instances are of a very wretched character?—Very.

1224. And that consequently, without casting any stigma upon your company, the supply may bear the title of being wretched and inefficient?—Quite so.

1225. Would you consider that before London, in its poorer districts, can be said to be supplied with water some imperative regulation should be brought into force to compel the owners of that property to make sufficient arrangements to receive the water which you are ready and willing to give?—There is no question of it. The company have done all they can to urge the thing upon the landlords; they have driven pipes to the doors of the houses where the supply was wanted, and yet in some cases the landlord will not go to any expense in making provision for laying on the water.

1226. Have you a difficulty in collecting the rates from that class of property?—I think not.

1227. Do you know whether you make many bad debts?—I think not.

1228. But I suppose that you would not wish to lead this Commission to believe that, although you are prepared to give and can give an abundant supply; London in its poorer parts is abundantly and well supplied with water?—It is not, but through no fault of the company.

1229. Therefore if there are complaints very loud, and very angry, there is some ground for them?—Yes.

1230. And it is necessary before London can be considered to be properly supplied that some additional regulations should be put in force for receiving, storing, and economising the water which you are prepared to give to every customer who applies to you?—It is most necessary.

1231. Supposing that under the present wretched arrangements your supply were to be constant in the 24 hours, what would be the consequences to you?—With present arrangements the thing would be impossible. I do not say that if all the arrangements in the houses were made as they ought to be, to receive a constant supply, we could not accomplish what is said to be accomplished elsewhere, namely, a reduction of the consumption to something like 15 gallons a head; that would be a boon to us and the public, but the preparation for such a supply would throw such an enormous expense upon the landlords that I do not think that they would make it.

1232. Do you think that it would really and truly be a large cost to the landlords to arrange for a proper supply; do you know what would be the cost of a three-eighths pipe per yard, and a three-eighths service cock, which would be quite sufficient upon the constant system for any single cottage-house in this metropolis?—Yes, with cottage property I think that there would be less difficulty.

1233. A half-inch pipe and a three-eighths tap, or a quater of an inch tap, according to the pressure, would be quite enough?—I do not think that the difficulty would arise so much with respect to cottage property so supplied if you could compel the landlords to do it; the expense must be trifling, but I still hesitate about leaving that class of property without the means of storing water at all on those occasions when mains have to be shut off for repair.

1234. Supposing that a service tank were made for a court which could be made of good cast-iron or wrought-iron, to contain 1,000 gallons, the cost would not be a very large one?—I have recommended it again and again, but landlords will not adopt it.

1235. You could arrange it by having an air valve on the top so as to prevent the water from wasting, and you could fill it every day, and each person could draw from it within his own house?—Yes, we are perfectly ready to supply under that arrangement, but landlords in most cases which I have tried will not adopt it.

1236. Are there many complaints made to you of defective supplies?—No, very few.

1237. Have you a complaint book at your office?—Yes.

1238. Would you object to let the Commission see that complaint book?—Not at all.

1239. What is the largest main which you have in your service?—We have 48-inch mains in connexion with the river supply. The largest pumping mains which we have under heavier pressure are 36 inches.

1240. What are the largest service mains in the city proper?—They range from 36 inches down to 3 inches.

1241. Do you know at what date your company began to use cast-iron, because I assume that the New River Company was established at a time when cast-iron had not been brought into use for services?—All their pipes originally were wood.

1242. How were the joints made?—The end of one pipe was sharpened and driven into the end of the other pipe, which was slightly widened.

1243. Was it luted with white lead?—I think not.

1244. Was there a wrought-iron strap?—I have sometimes seen a wrought-iron hoop to prevent the wood from being split.

1245. When did you begin to supersede the old wooden services?—I can give that date, but not from recollection.

1246. Were the first pipes flange pipes?—A number of them were.

1247. Are there any flange pipes in use now?—No, all the flange pipes have been taken up in consequence of the trouble which they gave from leakage by the contraction and expansion.

1248. What kind of joints have you now?—An ordinary socket run with lead.

1249. What form of socket do you generally adopt?—About 4½ inches in depth.

1250. What depth of lead would you give for the 4½?—Nearly the whole depth according to the plan adopted now; a ring of cold lead with molten lead run on it, so that the joint is made solid.

1251. You give the first caulking with cold lead, and the outer caulking with hot lead?—Yes.

1252. And you find that the best form?—Yes.

1253. Have you ever examined an old joint to see what has been the action of it?—I have examined many of them.

1254. Have you ever examined one under a microscope?—No.

1255. Are any of your mains laid so near the surface that the frost has at any time affected them?—I have known cases in the outlying districts where a small iron pipe has been frozen.

1256. How near would the top of the pipe be to the surface?—Probably 2 feet; the depth which is now always prescribed is 2 feet 6 inches from the top of the pipe to the surface of the road.

1257. Have you any prescribed distance at which you keep your water mains from gas mains?—There is a prescribed distance as regards the gas mains; they are required to be kept 4 feet from water mains, but that distance in the streets of London cannot always be kept.

1258. Are any of your mains interlaced with the gas mains?—Yes, in some of the more crowded places.

1259. Have you ever found inconvenience from the back draught of gas into your mains?—That has been an occasional accident, but only occasional.

1260. What do you consider the life of one of your cast-iron pipes?—Some of the very oldest I have found as good as on the day when they were laid.

1261. What number of years had they been in?—I should think 60 years.

1262. And they were sound then?—Quite sound.

1263. Do you varnish your pipes by Dr. Angus Smith's process?—I have tried it as matter of experiment, though it is hardly needful, inasmuch as all the pipes through which the New River passes become coated with the finest possible coating of lime which does not increase.

1264. It combines with the oxide of the iron and forms an enamel?—Yes.

1265. Do you cleanse and limewash your pipes before putting them down?—Yes, we hot lime them throughout.

1266. What are your service pipes made of?—The tenants communication pipes are almost all of lead; we recommend lead.

1267. Have you ever tried wrought-iron?—Yes, but it does not answer; corrosion takes place. I have known a wrought-iron pipe only last five years.

1268. Is the corrosion external or internal?—Apparently both.

1269. Has your water in any case to your knowledge any action upon lead?—Not the least.

1270. Neither in the cistern nor in the pipe?—Not the least.

1271. Have you many dead ends upon your service?—Yes.

1272. Have you any means of cleansing the water from the dead ends?—Yes, in all of them there are plugs on purpose.

1273. Have you an accurate plan of all your mains and services?—Yes, laid down upon the ordnance plan.

1274. So that if you wish to interfere with any section of your mains you can shut down your valves and isolate?—Yes.

1275. Have you much leakage upon your system?—I think not; because from very careful inspection, if leakage occurs, it is immediately discovered, if there is any leakage on the surface of course it is seen, and we have a periodical examination of the sewers, and by that means we some years ago managed to check a great deal of leakage. If you look at the tables of consumption returned from time to time by the New River Company you will find that our consumption has not very much increased, and that it is rather less now than it was some years ago, and it is entirely due to the stopping of leakage and waste.

1276. Your present mode of discovering leakage would be that when it comes to daylight you can see it, and if you have any suspicion of it you gauge the sewers?—Yes; it is not so much by gauging as by the men who enter the sewers, seeing where the leakage occurs and reporting it; and by paying them a small reward we have no difficulty in that respect.

1277. I think that the workmen themselves have a ruder method of trying whether a valve leaks by holding a bar to the ear?—Yes.

1278. What is the largest sluice valve which you use?—It depends upon the size of the pipe.

1279. Have you any arrangement for easing the friction of the larger valve?—No; a 36-inch valve is the largest under pressure, and we have had no difficulty in that case.

1280. To what height will the water rise from a fire-plug in the best portion of your district, that is to say, where the water would rise the highest and the freest?—The pressure in the mains is a very varying thing. I have seen the water go freely 70 feet, and in certain places it may be got higher.

1281. At points, such as that the intervention of a fire-engine would not be requisite?—It would not.

1282. That is not the condition of things over the whole of your services?—No.

1283. There are districts I daresay where you could not get 6 feet from the surface?—I should say none.

1284. In Victoria Street, where we are now sitting, there is a pressure of 150 or 200 feet, but I will guarantee that you could not get 3 feet from the surface?—Then it must be a very small main. If the water is not brought up by a proper jet pipe or nozzle in all probability you will not get it to rise a sufficient height, but if you have a proper jet pipe from which it can issue it will rise for some great distance.

1285. It must necessarily depend upon the length of the main and the distance which it is from the head, and the junctions which it has to pass, and the draught upon it?—Yes and the size of the main.

1286. And the number of branches?—Yes.

1287. In fact there are innumerable conditions to be taken into account?—Yes.

1288. Of what length is the New River in its entire length?—It is now about 28 miles.

1289. What is its cross section?—An average of 75 square feet.

1290. What is its fall per mile?—Its fall is from 99 feet to 82 feet in the whole distance.

1291. Do you find that in reality you are obliged to reduce the river into a series, as it were, of level branches?—Yes, we have to check it; we have too much fall.

1292. And therefore you put a series of small weirs?—Yes.

1293. And it regulates itself in that manner?—Yes.

1294. I suppose that practically that fall would not be more than about one in 10,000; about 6 inches per mile, that is to say, a surface fall of water?—Hardly so much as that.

1295. Then if you made a conduit to work without

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check it would not do to give a much greater fall than that?—No.

1296. Or you must give vertical checks as you now do?—Yes.

1297. Is the bed of the New River pitched in any way?—No.

1298. Is it in the same condition as Sir Hugh Myddelton left it?—In a great portion of its length it is.

1299. Is it of the same sectional area?—It is increased. In 1852 the company obtained an Act giving them power to improve their river from end to end by widening and straightening it. Its original length was about 38 miles, and it was reduced to 28. We have reduced it by cutting off loops, and in one case by a tunnel, and also by embankments.

1300. What is the average velocity of the flow?—I think that it is something like four-tenths of a mile per hour. That is what we require with the present consumption. We can increase that velocity as the demands in town increase.

1301. That, taken with the sectional area, gives you a volume with an adequate delivery?—Yes.

1302. What is that volume?—It is now 22,500,000 gallons per day.

1303. (*Mr. Harrison.*) And you say that you have the means of providing, if necessary, about 37,000,000 gallons a day?—I should think so.

1304. Would the aqueduct, as at present existing, pass that volume of water?—Quite easily.

1305. (*Chairman.*) What is the capital of the company; is the money capitalised?—There was an investigation in Parliament in 1852, the result of which was that the capital was fixed at about 1,500,000*l.*, or rather more, and the company were allowed to add a million to their capital by borrowing.

1306. Making it now 2,500,000*l.*?—Yes, and last session they obtained power to add a fresh capital of 500,000*l.*

1307. That would make a capital of 3,000,000*l.*?—Yes.

1308. Are you restricted in your dividend?—Only by the General Waterworks Clauses Act, to 10 per cent.

1309. What are you paying now?—I believe something like six per cent., or a little over.

1310. Have you fish in the river?—Yes.

1311. Have you any fishing rights retained for the company?—We retain in the New River itself all the fishing rights.

1312. Have the riparian owners through whose lands the river passes any fishing rights?—It has always been the custom of the company to allow persons having property on the banks to fish without hindrance. We are very particular as to strangers.

1313. Is the soil of the conduit vested in the New River Company?—Yes; the New River Company have by purchase acquired the banks of the river in a great many places, but in other places they have only vested in them that which the water covers.

1314. Do pollutions of any kind find their way into the river?—Not into the New River.

1315. Did they at any time?—Formerly they did. Drainage came into the river, but all that has been very carefully diverted and passed under or over.

1316. How many years ago was that done?—15 years.

1317. Can you say that now, as a fact, no sewage contaminates the water of the New River either from towns, villages, or single houses?—None.

1318. Then, as regards sewage contamination, the New River is as pure as it can be?—Yes, excepting the water now drawn out of the Lee. My answer to your last question had merely reference to the New River itself.

1319. As regards the New River itself your company have power enough and have accomplished the purification of the channel of the New River?—Yes.

1320. But as regards some of the water which you are compelled to take the pollution may take place before the water comes into your possession?—It may.

1321. Do you think that it would be advisable that that pollution, whatever it may be, should be utterly prevented?—Most advisable. The anxiety of the company to accomplish that freedom of the river from pollution is manifest from what they have done at Hertford. The works there cost more than 22,000*l.* They have drained the whole of Hertford, and have erected deodorising works, and in the carrying on of those works the outlay may be about 600*l.* a year.

1322. Is that entirely done by the New River Company?—Yes.

1323. They having no interest in the matter but to obtain pure water?—Yes, and it is an advantage in which the East London Company lower down participate.

1324. Do the East London Company pay any portion of that expense?—None at all; but we having done it for ourselves they get the benefit of it.

1325. (*Mr. Harrison.*) The East London Company have carried out similar works to some extent?—The New River Company, together with them, have done so; they contributed more than 8,000*l.* to the expense, and we have also done what we could to accomplish the purification of the sewage at Luton.

1326. (*Chairman.*) Then may this Commission assume that your company would give any assistance to Government to carry out a measure which should be an equitable one for the purification of the entire valley of the river Lee?—I am sure that it is a thing in which they would most heartily co-operate. Of course when the amount of contribution came to be settled a number of things would require to be taken into consideration, and I think among other things what the New River Company have already done to the same end; they have largely contributed to works for the purification of the streams.

1327. If they were called upon to do anything further they must see that it would be advantageous to themselves and to their customers?—Just so.

1328. (*Mr. Harrison.*) Did they not gain any benefit in being allowed to take a larger volume of water from the Lee, when they engaged to pay so much towards the improvement of the navigation below?—Yes.

1329. They had a *quid pro quo*?—Yes. I quite grant that they had more water on condition of their making a payment of I think 42,000*l.* towards the navigation works.

1330. What are the poor parts of London which you supply with water; do you supply St. Giles's?—Yes.

1331. Do you supply the neighbourhood of Covent Garden?—Yes. Our district is bounded on the south by the Thames, and by a line drawn from Charing Cross up to Hampstead Heath on the west, and by a line from St. Katherine's Docks up to Tottenham Church on the east.

1332. And following the Lee after that up to Hertford?—Yes; we have power to supply the intervening parishes of Edmonton and Enfield, and so on,

1333. Was there much cholera lately in the poor districts of St. Giles's and Covent Garden?—I think not; considering the kind of population, and the way in which they are housed, the amount of cholera was very small indeed.

1334. Have the metropolitan sewage works been thoroughly carried out in that district, in St. Giles's, for instance?—The upper and middle main level sewers have been constructed through those districts; the lower level sewer is not yet undertaken.

1335. (*Chairman.*) Are you rated to the sewers?—Yes.

1336. Are you within the metropolitan area for rating purposes?—Yes.

1337. Have you any idea what number of additional houses you could supply before you would get to the limit of your capacity?—We have of late years, I fancy, added about 1,700 houses annually to the number supplied.

1338. Is that increase going on now?—Yes.

1339. (*Mr. Harrison.*) And that is coincident with an actual diminution in the volume which you supply consequent upon the care which you take as to leakage?—At the date to which I refer there was a consider-

able saving in leakage. We now supply very nearly 30 gallons a head, taking the whole district.

1340. (*Chairman.*) What volume of the whole 22,500,000 gallons do you pump, and what volume do you supply by gravity?—I think that we are now pumping between 18,000,000 and 19,000,000 gallons.

1341. Do you know about what is your annual consumption of coal or slack?—I should think very nearly 9,000 tons.

1342. Is it the same material as the East London Company use, the Newcastle slack?—No, we have found the Welsh coal upon the whole answer better. We are in a district surrounded by nice houses, and the least appearance of smoke would be objectionable.

1343. What does that coal cost you per ton?—I have had it as low as 15*s.* per ton, but now the price is much higher. At our chief pumping station I should think that it may be 19*s.*

1344. Where is the chief pumping station?—At Stoke Newington.

1345. What number of boilers have you in use?—At that station we have 18, generally half on and half off. I should think that they are about 30 feet long and not quite so much as 6 feet in diameter; they have internal flues.

1346. Have you any ventilating apparatus?—Nothing but the sliding down.

1347. Have you any arrangement as to the mode in which your men fire?—Yes; they are carefully instructed in that respect.

1348. Have you double bridges?—No, a single bridge.

1349. Are the men instructed to fire to the front?—Yes.

1350. Have you any difficulty in getting your firemen to fire in that way?—No great difficulty; some men are slower than others in taking up the idea.

1351. Have you any patent in use?—No; there is no appearance of smoke at all during the greater part of the day, except just when the men are raking up.

1352. At what pressure do you use your steam?—About 35 lbs.

1353. You work expansively?—Yes.

1354. Do you give any bonus or extra wages to your men for accomplishing smoke burning?—At the end of the quarter we give them a bonus if they have behaved very well.

1355. You hold it out as an encouragement for care?—Yes.

1356. What are their wages?—The stokers, I think, have from 21*s.* to 25*s.*

1357. Do you find them residences?—In some cases.

1358. And firing?—Yes, in the case of those who live on the company's ground.

1359. You have no difficulty in consuming or preventing smoke by ordinary firing without the intervention of any special patent?—None whatever. By the use of Welsh coal it is almost impossible to make smoke.

1360. Is it anthracite coal?—It is the Merthyr coal.

1361. Do you think that you could fire with the Newcastle, slack in the same way and not make smoke?—I think not; it requires so much more care that we could not always depend upon it.

1362. Are any of your works near Hertford?—The sewage works and also the gauge which might be an interesting matter. I have drawings which I can show you.

1363. Perhaps you have also some documentary evidence which you might wish to put in upon points as to which we have not asked you. Have you kept a rain gauge?—We have.

1364. Will you let us have a copy of the rain guagings?—Yes. (*The witness subsequently furnished the same, and it will be found printed at the end of his evidence, Appendix No.* 2.)

1365. Have you any evaporation gauge?—No. (*The witness produced some plans and explained them to the Commissioners.*)

1366. Is there anything else which you wish to mention to us?—I am not aware that there is.

The witness withdrew.

Adjourned to to-morrow at 10 o'clock at Luton.

APPENDIX No. 1.

To the evidence of James Muir, Esq., Engineer-in-Chief, (referred to supra, Question 1086).

Analysis of Hertford Sewage.

College Laboratory, London Hospital,
Dec. 27th, 1866.

My dear Sir,

I have to report to you the results of the examination of the two samples of Hertford sewage which you sent here on the 15th inst.

They were contained in stoneware gallon bottles, and were labelled as follows:—

No. 1. Sample of undeodorized sewage. Dec. 13, 1866, 11 a.m.

No. 2. Sample of deodorized sewage. Dec. 13, 1866, 11.25 a.m.

Both the samples were somewhat turbid, No. 1 being most turbid; and they had the peculiar odour of sewage, although it was not very strongly marked in sample No. 2.

Their constituents per imperial gallon were as follow:—

	No. 1.	No. 2.
Soluble matter per gallon	30·33	27·00
Consisting of organic matter	5·35	2·51
„ „ mineral matter	24·98	24·49
Suspended matter per gallon	5·39	0·74
Consisting of organic matter	0·71	0·24
„ „ mineral matter	4·68	0·50
Total organic matter per gallon	6·06	2·75
Total mineral ditto	29.66	24·99
Total per gallon	35·72	27·74

It is evident from this that at first the sewage is largely diluted with water, and that after deodorization and filtration it is almost innocuous.

I remain, &c.,

James Muir, Esq. (Signed) Hy. Letheby.

APPENDIX No. 2.

New River Waterworks Company.

To the evidence of James Muir, Esq., Engineer-in-Chief, New River Waterworks Company (referred to supra, Question 1364).

Rain Gaugings—Hoddesdon.

	1860.	1861.
January	3·400	·850
February	1·500	2·300
March	2·200	3·005
April	1·300	1·280
May	4·003	1·330
June	5·550	1·950
July	2·000	1·950
August	4·005	·550
September	2·700	1·800
October	1·700	·700
November	2·400	4·600
December	1·600	1·200
	32·358	21·515

LONDON.

Mr. J. Muir.

11 Dec. 1866.

RAIN GAUGINGS—HODDESDON—*cont.*

1862.	
January	2·000
February	·380
March	3·400
April	2·600
May	2·800
June	2·300
July	1·320
August	2·650
September	1·480
October	3·450
November	1·400
December	1·750
	25·530
1863.	
January	3·430
February	·700
March	·850
April	·750
May	1·000
June	3·940
July	·780
August	1·800
September	2·800
October	2·100
November	2·005
December	1·350
	21·505
1864.	
January	·900
February	·730
March	2·600
April	·730
May	2·200
June	1·550
July	1·000
August	·730
September	2·230
October	1·005
November	2·130
December	·600
	16·405
1865.	
January	3·650
February	1·880
March	1·350
April	·280
May	2·400
June	1·500
July	2·200
August	3·560
September	·600
October	5·350
November	2·300
December	1·000
	26·070
1866.	
January	3·600
February	4·005
March	1·750
April	1·950
May	1·150
June	2·220
July	1·650
August	2·200
September	4·400
October	2·550
November	1·950
December	2·500
	29·925

RAIN GAUGINGS—ENFIELD.

1860.	
January	3·370
February	1·490
March	2·450
April	1·830
May	4·340
June	5·770
July	2·020
August	4·930
September	3·010
October	2·130
November	3·370
December	2·415
	37·125
1861.	
January	·550
February	2·060
March	2·820
April	·795
May	1·195
June	1·810
July	2·945
August	·630
September	1·875
October	1·015
November	4·740
December	1·285
	21·720
1862.	
January	2·380
February	·385
March	4·125
April	2·070
May	3·180
June	2·635
July	1·475
August	2·390
September	2·030
October	4·955
November	1·300
December	2·085
	29·010
1863.	
January	3·395
February	·615
March	·935
April	·795
May	1·400
June	4·485
July	·995
August	1·985
September	3·560
October	2·010
November	2·350
December	1·430
	23·955
1864.	
January	·895
February	1·170
March	2·715
April	·650
May	2·110
June	1·325
July	·620
August	1·250
September	3·165
October	1·245
November	2·810
December	·535
	18·490

RAIN GAUGINGS—ENFIELD—*cont.*

1865.

January	3·810
February	2·235
March	1·650
April	·345
May	3·266
June	1·430
July	2·485
August	5·650
September	·680
October	7·075
November	2·600
December	1·570
	32·796

1866.

January	4·630
February	4·080
March	1·430
April	2·245
May	1·540
June	3·150
July	2·350
August	2·340
September	4·440
October	2·540
November	2·160
December	2·776
	33·681

RAIN GAUGINGS.—HORNSEY.

1866.

January	3·375
February	2·980
March	1·490
April	1·890
May	2·020
June	4·440
July	1·420
August	2·090
September	4·200
October	2·220
November	1·630
December	2·460
	30·215

RAIN GAUGINGS.—NEW RIVER HEAD.

1866.

January	2·440
February	3·390
March	1·510
April	1·730
May	2·008
June	3·650
July	1·280
August	1·910
September	2·550
October	2·100
November	1·500
December	1·980
	26·048

Luton, Wednesday, 12th December 1866.

PRESENT:

ROBERT RAWLINSON, ESQ., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, Esq. | Professor JOHN THOMAS WAY.

Mr. WILLIAM THOMPSON PLEDGE (Luton) examined.

1367. (*Chairman.*) Are you chairman of the Local Board of Health?—Yes.

1368. When was the Act applied to Luton?—In 1849.

1369. Who made the first report?—Mr. Creasy.

1370. Then you adopted the Act very early?—Yes.

1371. What is the population of Luton?—It is now upwards of 20,000.

1372. Is Luton a growing place?—Very much so, indeed; we have built in the last seven years 900 houses within the township.

1373. Do you know what the rateable value of the township is?—About 40,000*l.*

1374. Have you carried out any main sewage in Luton?—Yes.

1375. Has the town a water supply?—We have not a water company; it is supplied from wells; there are about 1,200 wells in the town.

1376. Your water supply is from wells?—Yes.

1377. Do you know what the main sewerage you have carried out has cost you?—No, but the clerk will tell you that.

1378. What trade is carried on in Luton?—The staple trade of the town is the manufacture of straw bonnets and hats.

1379. Does the river Lee, which supplies part of London with water, flow near to your town?—It flows through the town, and it rises about three miles from here.

1380. So far as you know is there or not any amount of pollution turned into it from this town?—I think not. We deodorize all the sewage before it goes into the Lee, beyond that there is no pollution of the water.

1381. What form of deodorization do you use?—We use chloride of lime and lime. The sewage passes through several filtering beds, and after that it is turned into the Lee pure.

1382. In what condition is the sewage after it has been so chemically treated?—I cannot speak to that.

1383. When you speak of it as being purer I assume you mean that it looks brighter?—Yes.

1384. Would you be surprised to hear that it was no purer then than before you treated it chemically?—Yes, I should be.

1385. I mean the liquid part of it?—Yes.

1386. Assuming that a chemist would tell you that all the ingredients of sewage are still in it, should you not then consider that it would pollute the river?—I should like to have some evidence of it before I gave an answer to that question.

1387. If there is pollution in the sewage, and the sewage goes into the river, does not the rest follow?—Yes, if it goes into the water.

1388. If the sewage which has been treated by you chemically is turned into the Lee, and it has still impurity in it, that also must go into the Lee?—Yes.

1389. It follows that the amount of impurity or the amount of pollution depends upon the chemical condition of the water after it passes from your works?—Exactly so.

1390. Did you clarify the sewage when you first carried out your sewers?—The sewerage was carried out before I became a member of the board, and I cannot speak to that.

1391. Before the board existed, or any works were executed, what arrangement had you with regard to privies, or waterclosets, or cesspits?—None whatever; all the sewage then passed into the Lee from any closets and surface drainage. We had no provision until we made an intercepting sewer.

1392. Were there any privies at that time built over the watercourse?—I believe there were some on

LUTON.

Mr. W. T. Pledge.

12 Dec. 1866.

the margin of the river, but I cannot speak to that as a fact.

1393. How long have you lived in Luton?—24 years.

1394. Do you know whether any privies or closets stand now on the margin of the river?—I do not know of any. I do not believe there are any in the township. I have paid much attention to this subject, and in my survey of the town I have seen none.

1395. Do you know anything of the district towards the sources of the river?—I do not.

1396. Or towards Dunstable?—No.

1397. Do you know anything of Dunstable?—No.

1398. (*Mr. Harrison.*) Can you give the population of Luton in successive decennial periods?—I cannot give you that information.

1399. Does any pollution arise from the manufactures that are carried on in the town?—We are rather troubled now with the dyeworks, although we appear to take a large amount of pollution out of the spent dye liquor, we are rather troubled with the colour that is left in it; it will not sink, otherwise I believe that the pollution in the sewage is completely taken away.

1400. Is there any other business carried on in Luton besides the dyeworks which pollutes the river?—No; I believe that the bleaching of the plait does not do so.

1401. Is the refuse from the bleaching and the dyeworks carried into your sewer?—Yes, into the intercepting sewer.

1402. No refuse passes direct into the Lee?—None is allowed to go into the Lee without going first into the intercepting sewer.

1403. Has your board ever contemplated the application of the sewage to land?—Yes, but not by way of irrigation.

1404. Have you heard that sewage elsewhere is successfully applied to land?—I have heard so.

1405. In your elevated position here I suppose there would be no difficulty in applying it to land by gravitation without pumping?—I think we could not do it without pumping.

1406. Is there any land in this neighbourhood which is suitable for its application?—I do not know.

1407. When you carried out your system of purification did you receive any sum of money from the New River Company to assist you in doing it?—I believe not.

1408. Did they assist you in any way?—Not at all, I believe.

1409. Can you give us any information as to the health of the town?—The health of the town stands rather high, and I believe it is in a tolerably satisfactory state.

1410. Do you know what the death rate of the town is?—I do not.

1411. (*Professor Way.*) Your principal manufacture here, I believe, is straw plait?—Not the manufacture of straw plait that is carried on in the villages; here it is bleached and dyed and manufactured into bonnets and hats.

1412. All the dyeing is done here?—Yes.

1413. What quantity of plait do you imagine is dyed or bleached in Luton in a year?—I am unable to speak to that.

1414. Do you know what method is adopted in bleaching the plait?—I do not.

1415. With regard to the question of sewage precipitation, which the chairman brought before you, you are aware that the evils of sewage lie in two forms: objectionable matter in a state of suspension, and objectionable matter in a state of solution?—Yes.

1416. The chemical process which you use for deodorizing is the lime process?—Yes.

1417. Are you aware that that simply removes the matter in suspension?—I am not aware of that.

1418. It enables you to send away a clear liquid without the solid parts into the river, and consequently you so far improve the condition of the sewage; but by that process, as the chairman wished to point out to you, you do not take anything out that is dissolved in the liquid, and therefore that must add to the impurity of the river?—Yes.

1419. (*Chairman.*) Is there anything further that you wish to add?—No.

The witness withdrew.

Mr. W. D. Sandoe.

Mr. William David Sandoe (Luton) examined.

1420. (*Chairman.*) How long have you been surveyor to Luton?—About four years.

1421. How long has the present system of sewerage been carried out?—For something like eight or nine years, I believe.

1422. Who devised them?—I believe Mr. Evans, who was then the surveyor to the board of health.

1423. Do you know what size the outlet sewer is?—3 feet by 2 feet 6 inches.

1424. Do you know what length of main sewer there is altogether?—The intercepting sewer is about a mile in length.

1425. What size is it?—3 feet by 2 feet 6 inches.

1426. What length of tributaries are there, do you know?—Not the total.

1427. Do you know what number of houses you have drained?—The whole of the houses are drained in the township.

1428. What sized drain do you generally use for single houses?—6 inches.

1429. Are they of earthenware pipes?—Yes.

1430. Are the main sewers ventilated?—Yes; that is to say, the intercepting sewer, but not the others.

1431. Not the sewers in the town?—No.

1432. Have you ever heard any complaints made by any persons of foul smells issuing from the gully holes or the sinks?—Very rarely. I have occasionally when the gullies have been emptied, and when the water was out, but no other complaint.

1433. Are the down spouts from the eaves of the houses connected with the drains?—There are a few.

1434. Have you any idea what number of water-closets there are in use in the town?—Somewhere from 1,000, to 1,500.

1435. If you have no water supply other than from pumps, what arrangement have you for flushing the closets?—It is chiefly done by rain water in addition to the pumps.

1436. Have the closets cisterns?—Yes; the majority of them.

1437. And are they filled with rain water?—Yes.

1438. And in addition there are pumps attached to force the water up?—Yes.

1439. Have you anything to do with the management of the closets if they get out of order; for instance, do you expect the parties to put them in repair?—Occasionally I have been called in to suggest any alteration that might be required.

1440. Are soil-pans used in the dwellings of the working classes?—A few, not a great many; they have open privies chiefly, which are constructed with proper emptying holes.

1441. You mean with a cesspit?—Yes.

1442. How many of those do you suppose there are in the town?—Somewhere about from 2,000 to 3,000 altogether.

1443. How are they emptied?—The board of health have lately adopted a plan of doing it by night-carts.

1444. Are they emptied at the cost of the owner of the house, or at the cost of the ratepayers?—We make a charge for the men's time; there is no further charge; we charge 2*s.* for the emptying of each closet, which covers the expense.

1445. Is the refuse sold to the farmers?—Yes; we are mixing it now with the refuse from the deodorizing works and the ashpits.

1446. Has the practice of emptying those places by the local board come into operation recently?—Yes, within the last six months.

1447. Then you have not had much experience of the working of that plan?—Not at present.

1448. Before that who emptied the cesspits?—The contents were taken away by farmers in the neighbourhood chiefly.

1449. Was that operation a nuisance?—Many complaints were made to the Local Board of the way in which the closets were emptied, which induced them to adopt the present plan.

1450. How long have the precipitating works been in operation where the sewage is treated by lime?—Ever since the construction of the main sewerage; it was carried out under the same contract.

1451. Do you know what amount of lime you use now in each month or year?—We used something like on an average, previous to the last six months, 80 quarters in a month, or about 20 quarters in a week, eight bushels to the quarter. Since that time we have used something like 7½ quarters, and in addition to that we use something like 40 lbs. of chloride of lime per day.

1452. What does that cost you?—About 19*s.* a hundredweight.

1453. What does it cost a day?—About 8*s.* or 9*s.*, exclusive of the wages of the men.

1454. What number of men do you employ?—Five.

1455. What do they cost you?—About 4*l.* 10*s.* 0*d.* a week.

1456. What do you estimate the present cost per annum of your outlet works?—From 400*l.* to 500*l.* a year.

1457. What volume of water have you to deal with from the sewers?—Something like about 240 gallons a minute, but that includes a large quantity of spring water. I should say that there is not more than a fifth of that actual sewage matter.

1458. There is a large amount of spring water which percolates into the sewers and drains from the subsoil?—Yes.

1459. And to deal with that water you say it costs the local board at present from 400*l.* to 500*l.* a year?—Yes.

1460. Does that include any portion of your own salary?—No, it does not; that is the actual cost of the labour at the works.

1461. What weight of solid matter do you take out of the depositing tanks per week, month, or year?—We take out something like 2,000 square yards per annum.

1462. You mean cube yards, do you not?—Yes.

1463. What weight do you think a cube yard would be—a ton?—Rather more; it is about a ton when we cart it away in a dry state.

1464. Do you actually take out of the depositing tanks 2,000 tons a year?—Yes, as nearly as possible, exclusive of the ashes and the sewage matter that we take from the cesspools.

1465. (*Professor Way.*) How do you bring it into a dry state?—We have separate settling beds which we pump the sewage from, in a semi-fluid state to the other side of the river on to some land which belongs to the Board of Health, it lies there in large beds a foot thick for about a month or five weeks, and when it is solid we wheel it out into large heaps for the farmers to cart away.

1466. It is not dry; is it not in a cheesy state?—It is very nearly dry when the farmers get it.

1467. (*Chairman.*) You say that you take out upon the average nearly seven tons a day, reckoning six working days in the week?—Yes, I think that is nearly it.

1468. Where do you suppose that comes from?—From the various closets, and there is a great deal of road refuse also that goes into the sewers.

1469. Road grit that washes through the gully holes into the sewers?—Yes.

1470. Then a great portion of that weight will be road grit?—Yes.

1471. Have you any difficulty in getting rid of that matter for agricultural purposes?—Yes, we have had great difficulty in getting rid of it up to the present time, until we mixed the nightsoil with the street sweepings; but I apprehend from the applications that I have had for the manure, and taking into account what has been actually sold, that we shall have no difficulty with it now.

1472. What price do you get per load for it, or what have you got?—At the present time we sell it at 2*s.* 6*d.* a load, which is a cube yard.

1473. About a two-horse load?—Yes, very little more than a ton, or a ton and a quarter.

1474. How far do the farmers take it?—Some of the manure that I have sold lately has been taken a distance perhaps of three miles.

1475. Have you any difficulty at any time of the year in getting rid of the accumulation?—No, other than what I have mentioned. The farmers at one time had a prejudice against it, thinking that the manurial properties were destroyed by too much water, or the quantity of lime that was then used.

1476. Do not you find it more easy to get rid of it when the farmers are not engaged either in sowing or in reaping?—Yes, that is the case certainly.

1477. Have you any accumulation on hand to any extent?—We have had a large accumulation, something like from 2,000 to 3,000 yards on hand.

1478. Do you know what the outlet works cost?—The whole of them from 10,000*l.* to 15,000*l.*

1479. Including the sewers?—Yes.

1480. Have you any plan of the outlet works?—There is one.

1481. How far are the works from here?—About half a mile.

1482. Has it never occurred to you that it would be advisable that you should permanently ventilate your main sewers?—Yes, it has; I think it is very advisable to do so.

1483. Do you ever find any smell, or have any persons complained of it when the ground has been opened to make a junction?—Not much; I have never had any serious complaint made.

1484. Do you know the difference between the condition of the sewage water before and after it has been limed?—No, I do not know that.

1485. Has your board had any analysis made of the water in those two conditions?—I believe it has been done, but not lately; not since I have been Surveyor.

1486. Has it ever been intimated to you that the liming process simply enables you to take out the solids?—It has.

1487. However bright the water is after that process, it is in reality the same sewage afterwards as it was before?—I always understood that there were certain portions in the water which could not be taken out by any known process.

1488. Would you be surprised to hear that the liming process and the use of chloride have no effect whatever, except to brighten the water and to take out the solids, or those particles which are suspended?—I am not surprised to hear that, because it seems to me feasible.

1489. Have you visited any places where sewage is applied to land for irrigation purposes?—I have not.

1490. I assume that the valley below your outlet is principally chalk?—Not the valley; the hills are all chalk, but not the valley, unless you go to a very great depth.

1491. The valley I suppose will consist of gravel or lime?—It is chiefly bog, loose bog, and gravel at the bottom.

1492. Is there any brick earth in it?—I do not know of any. I think that that would be further down than I have any knowledge of. I have heard of the

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success at Croydon from applying the sewage to land for irrigation.

1493. Do you think it would be advisable, if your board could save their 500*l.* a year and get rid of the nuisance altogether, to try that process?—I should think it would be.

1494. If in this district you could so apply that sewage to the land as to produce 50 or 60 tons of green crops per annum off each acre, do you not think it would be advisable to do so?—I have no doubt that it would be a great advantage to apply the sewage in a liquid state.

1495. You are expending at the present time 500*l.* a year apparently without any use or advantage, and if a chemist will tell you that his experience enables him to say that you have made no alteration in the sewage which you have subjected to your process, except taking out the solids, and that is still sewage after that treatment, is not that an additional reason why something more should be done, and that you should purify the water before it flows on to London to be drank?—Yes.

1496. Especially if that could be done at a less cost to the board than it has now to bear?—Yes.

1497. (*Mr. Harrison.*) The town of Luton is situated on both sides of the river, is it not?—Yes.

1498. Has the system of sewerage been extended to both sides?—Yes.

1499. Has it been carried under the river in order to be connected with your main sewer?—Yes, under the Lee.

1500. You have stated that there are about 1,000 waterclosets and about 2,000 cesspits in the town?—Yes.

1501. For a population of 20,000 persons?—Yes.

1502. Are the waterclosets chiefly in the houses which are occupied by the wealthier inhabitants of the town?—Yes.

1503. How are the cesspits situated with respect to the houses generally?—The majority of them are something like seven or eight yards from the houses.

1504. Are any of them close to the houses?—Some of them are.

1505. Are any of them placed under the houses?—Not one that I know of.

1506. In the case of those which are near to the houses, have you ever known them to be the cause of ill health?—No; but I have had some complaints as to those which have been close to the houses, and I have recommended that they should be filled up, and that waterclosets should be substituted.

1507. Are they generally closed over the top?—Not generally so; there are some that are closed, but it is not the general rule.

1508. Are ashes thrown into them in any cases?—I have found a good many which have been altered within the last 12 months. We altered them so far as making proper emptying holes and cesspits awayfrom the ashes and closing the cesspits on the outside.

1509. These are the steps you have taken to separate the ashes coming from the houses entirely from the watercloset refuse?—Yes.

1510. Then there are ashpits and cesspits?—Yes.

1511. The cesspits you have had covered?—Yes.

1512. Are those cesspits sunk into the ground?—Yes, about 3 feet down is the usual depth.

1513. What is the character of the soil in which they are made?—The principal portion of the town is upon chalk.

1514. What steps are taken in constructing those cesspits to prevent the matters contained in them escaping into the chalk?—They are steined inside with brickwork, and in some cases brickwork in cement, but not in all.

1515. Are those cesspits water-tight?—Those that have brickwork in cement would be water-tight, but not the others.

1516. Where are the wells situate from which you say the inhabitants obtain their water with reference to the cesspits?—The cesspits are generally at a distance from the wells, from 7 to 10 yards; we have the wells now at the greatest distance we can from those places.

1517. Do you think that any such care as that will prevent the water from the wells and the refuse from the cesspits meeting together in the chalk subsoil, especially as you are withdrawing in your main sewer and your branch sewers so considerable a quantity of water through the chalk?—No, there is no doubt that it must be the case.

1518. That the cesspits do pollute the wells?—Yes, to a certain extent, there is no doubt of it.

1519. Do you think that that can be a satisfactory or safe water supply for the town under such circumstances?—I do not think it is.

1520. Do you not think that that is a point that ought to be brought under the notice of your local board so as to prevent the continuance of such a system?—This matter has been brought to the notice of the board, and in addition to that there was a water company started sometime since which it was contemplated would entirely obviate the difficulty then, but the works have not yet been carried out. I believe they are in progress, at least I have heard so.

1521. Have the medical men of the town on any occasion complained of the water that was supplied to the inhabitants for drinking purposes?—In one or two instances I have heard a complaint, but no general complaint has been made.

1522. What steps, if any, have you taken in those cases to prevent the continuance of the evil?—In any case where I have found any mischief arising from a drain, (I have not heard of a case arising from a closet) I have altered it at once.

1523. How far is the outlet of the main sewer from the town?—About half a mile.

1524. You say that you take the solid refuse and convey it into large shallow tanks?—Yes.

1525. You then, I suppose, allow the water to evaporate from the surface until the solid matter becomes of a certain consistency?—Yes.

1526. Does any smell arise from the tanks during that operation?—We do not find that there is any unpleasant smell.

1527. That is in consequence, I suppose, of your applying chloride of lime?—Yes.

1528. You applied that in consequence of finding that there was something objectionable?—No; the principal reason why I recommended it to the board was on account of the dyeing.

1529. Did you find that the effect of using chloride of lime was to diminish the pollution of the water by the dyeing process?—Yes, very much so.

1530. What was the effect?—It took the colour out.

1531. (*Chairman.*) Where could water be obtained if works were established for supplying the town?—From an artesian well, I imagine.

1532. And by the use of steam power?—Yes; I believe there would not be a sufficient supply of water from the river.

1533. Do you know what estimate has been made for the purpose of carrying out such works?—No; I have not heard.

1534. (*Professor Way.*) In your liming process, how is the lime applied?—By Higgs' patent; simply by mixing it in pans, and forming a kind of thin cream.

1535. How is that apportioned to the sewage?—It is managed by a tap which either flows with more or less water, as is required for the quantity of sewage coming in.

1536. Is it passed into the conduit that brings in the sewage?—Yes, and it is mixed with stirrers, which are worked by a water-wheel.

1537. Is it any distance above the subsiding reservoirs?—No, close to them.

1538. Have you more than one subsiding reservoir?—Yes.

1539. Is one filling while the other is subsiding?—They are all working regularly round; there are three large beds something like 1,000 yards square.

1540. Is there much collection of matter at the top of the reservoirs?—Not on the surface of the water.

1541. In running off the liquid do you run it through an opening a little distance above the bottom of the tank?—They are always running off.

1542. Is that from the surface outfall?—Yes, it is over the surface in working the water-wheel.

1543. I am speaking of running the liquid out of the tanks; how does the liquid overflow?—It works on a level; all the beds work on one level.

1544. In flowing into the outfall does it flow from the top?—Yes.

1545. Is there any plank to keep back the solid refuse which collects at the top?—Yes.

1546. (*Chairman.*) Do you use a skimmer?—No, we do not require anything of the kind.

1547. (*Mr. Harrison.*) Is the water which is pumped from your wells very bright?—Yes, it is very clear water.

1548. Are you aware that sometimes water is even more agreeable to the taste after it has been polluted by the drainage of cesspits?—I have read such an account.

1549. If so, do you not think it would be well to look into the condition of the water in this case, and not merely be guided by its appearance or its taste?—I should think it would.

1550. (*Professor Way.*) I daresay you have heard that lately in the city of London numerous wells have been shut up on the authority of a report made by Dr. Letheby?—I have.

1551. (*Chairman.*) Have you any idea what volume of dye water passes into the sewers from the intercepting one?—I have not.

1552. What number of dyeworks are there in the town?—I do not know.

1553. Do the dyers themselves attempt by any means to clarify the water or to take out any solids before they pass it into the sewers?—I do not think that that is the case; it may be so in one or two instances.

1554. You do not, perhaps, know the substances which are used in dyeing?—No.

1555. Are there any breweries in the town?—Yes.

1556. Are they large ones?—One is a tolerably-sized brewery.

1557. Do you know whether the brewers pass any washings of barrels or spent hops, or anything of that description, into the sewers?—I believe they pass the washings of barrels and those things into them.

1558. Any spent hops or spent grains?—I think not.

1559. Are there any malting places in the town?—None that are at work.

1560. Are there any mills above or below the town immediately on the river?—There is one immediately below the town, not above.

1561. What length of highways have you under your charge?—Somewhere about 30 miles.

1562. Of what are the street surfaces generally formed in Luton?—They are made of macadam.

1563. Are they all macadamised?—Yes, all of them.

1564. Have you any idea what weight of stone or flint is put on to the streets in a year?—It is from 2,000 to 3,000 cubic yards.

1565. Does that nearly correspond with the quantity of material that is taken out of your settling tanks. I think you said that you take about 2,000 tons out and you put about 3,000 tons on to the roads?—Yes, but there are a great many roads that do not wash into our sewers.

1566. The whole of the material which you put on is ground up by the action of the traffic over the roads during a year?—Yes.

1567. How much does it cost per cube yard to dress a road; is it flint?—Yes; the flint we use costs us about 5*s.* 6*d.* per cube yard.

1568. Do you use anything besides flint?—We put granite down upon some of the principal streets.

1569. What does that cost you per cube yard?—About 12*s.* 10*d.*, delivered at Luton.

1570. How many square yards of road do you repair out of one cube yard of material?—About six yards, that is to say I mean six yards across the road; it would be about 30 or 36 yards, not more than two inches thick.

1571. Are your side channels paved, or are they generally macadamised?—They are generally paved.

1572. After you have had a heavy fall of rain the grit washes into the channel and washes from the channel into the sewer?—Yes; but we have gully pans which take a certain portion of it.

1573. How much will a gully pan hold?—Not so much as half a cube yard, not more than a quarter.

1574. If you have a heavy rainfall will the gully pan be filled in a few seconds?—That depends upon the situation a great deal; at the bottom of the hill it would no doubt be the case.

1575. It would not last for many minutes?—Not in the lower part of the town.

1576. For any intercepting purposes it is a mere delusion?—It does not stop a great deal.

1577. Do the drains choke at any point?—No.

1578. Can you flush them artificially?—No.

1579. Have you never had occasion to resort to artificial flushing?—No.

1580. And the ordinary action of the water is sufficient to keep your drains in operation?—Yes, just so.

1581. To flush out all that weight of material that there is towards the outlet?—Yes.

1582. What is the fall towards the outlet?—I cannot tell.

1583. Have you often had occasion to open drains in order to put in connexions?—Very often.

1584. Have you noticed the condition of the drain when you have opened it; have you found any deposit in it?—Very rarely; in some situations, but the drains are generally pretty clean.

1585. Of what sizes are the tributary drains?—From 2 feet down to 9 inches.

1586. What are the 2 feet drains made of, brick or earthenware pipe?—They are made of brick, $4\frac{1}{2}$ inches.

1587. Are they circular or egg-shaped?—Some are circular; they are chiefly egg-shaped.

1588. Of what material are the 18-inch and 12-inch drains made?—They are earthenware pipes.

1589. I suppose it is in fact the large volume of subsoil water that is constantly running through your sewers and drains that keeps them clean?—Yes.

1590. If you had less of that water there would be more impurity in the drains?—Yes.

1591. That spring water is a sort of safety valve carrying off what would be deadly for want of ventilation?—Yes.

1592. If ventilation is a benefit under any conditions, do not you think it would be a great benefit, although your sewers may not be so foul as in other places, to have them fully ventilated?—Yes.

1593. (*Mr. Harrison.*) Have there been on any occasion any complaints made in the upper parts of the town of bad smells arising from the drains?—I have occasionally heard a few complaints made when the house drains have not been properly trapped.

1594. (*Chairman.*) If there is a foul smell before, what do you think becomes of the gas when they are trapped?—It must remain in the sewer.

1595. But will it remain there; if you do not control its coming out it will come out in its own way, and if your sewers are not properly ventilated I am afraid they will do as much harm as good?—No doubt they ought to be ventilated.

1596. (*Professor Way.*) You stated I think that you had considered the question of applying the sewage direct to the land?—Yes.

1597. Has the subject been taken up at all by the local board of health?—No, it has not.

1598. In considering that matter, probably the quantity of water would have something to do with it?—Yes.

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1599. Are you aware that at Croydon, where the sewage is applied to the land, the quantity of water, as in your case, which passes into the sewers is from two and a half to four times as much as the bulk of the sewage itself?—Yes, there is no doubt of that; that is the case to a certain extent here, but I think the difficulty here will be the land.

1600. (*Chairman.*) Is there anything further which you wish to add?—I think not.

The witness withdrew.

Mr. G. Bailey.

Mr. George Bailey (Luton) examined.

1601. (*Chairman.*) You are clerk to the local board of Luton?—Yes.

1602. How long have you held that appointment?—Since July 1851.

1603. Were you appointed upon the first formation of the board?—Almost; the board was formed about May 1850.

1604. Immediately upon the formation of the board, or was it after your appointment, that they began to carry out a system of main sewerage?—The board commenced immediately to make sewers, but the first sewers that were made were not upon a well defined system although they were well laid out. In 1856 a scheme was devised by Mr. Evans, who was a civil engineer, and the whole of that scheme was carried out under the superintendence, in the first instance, of Mr. Bazalgette and subsequently of Mr. Page; those gentlemen frequently came down to look

1605. Had the local board any special reason for carrying out a system of sewerage at that time; was any pressure put upon them by official authority?—A suit was commenced against us in 1856 or the end of 1855. A bill was filed in Chancery by the Attorney-General at the relation of John Shaw Leigh, the owner of Luton Park, and the information and bill of complaint were filed on the 13th December 1855. Evidence was given upon the occasion. I was present and gave evidence with numerous other persons, but the evidence was given by affidavit. The result of the suit was an injunction, a copy of which I hold in my hand, and, with your permission, I will just read the end of the bill of complaint—"Prayer. The infor- "mant and plaintiff pray as follows: 1. That the "township of Luton local board of health may be "restrained, by the order and injunction of this "honourable court, from causing or permitting any "sewers or drains, or the filth and matter coming "therefrom, to empty themselves or run into the "river Lee, and from otherwise polluting and injur- "ing the said river, or keeping the same sewers and "drains so as to be a nuisance or injurious to public "health. And also from opening any new drains or "sewers communicating with or discharging them- "selves into the said river, or any openings in sewers "already communicating with the said river, by "means of which openings additional sewage would "be brought into such sewers, and from in any manner "increasing the sewage passing into the said river. "2. That the defendants may pay the costs of this "suit." I may say that we never paid the costs. I do not know the reason why, but they were never pressed for. What the New River Company had to do with it I do not know.

1606. Were your intercepting sewers and your disinfecting works devised in order to comply with the terms of the injunction?—Yes. After that we had a correspondence with Mr. Higgs, a gentleman who seemed very ingenious in his ideas; he had invented a system of deodorizing the sewage and he had taken out a patent. I do not think I have a copy of it, but it can be obtained. The result of the communication or of my interviews was this, that the board of health purchased the patent for 700*l.*

1607. They gave Mr. Higgs 700*l.* for his invention?—Yes; and we were compelled to use the process. I believe that it has been a great saving to the town, and has prevented litigation, probably many thousands of pounds, and we have lived in peace.

1608. (*Mr. Harrison.*) Does Mr. Higgs in that agreement undertake to purify the water so as to prevent your being further interfered with by parties below?—No; but the suit has this effect, that so long as we use his patent properly the court have no power over us.

1609. (*Chairman.*) You have complied with the order of the court?—Yes; it says, after stating that it shall not flow into the river, "except such sewage "water or matter shall have been previously subjected "to the process for purification, known as Higgs' "process." I believe Mr. Higgs has been dead for some time.

1610. I suppose the patent has expired?—I do not know.

1611. (*Professor Way.*) Were affidavits referring to the nature of the patent put in?—No. The fact was, I believe, that Messrs. Baxter, Rose, and Norton were concerned for the informant or the plaintiff. I believe that Mr. Baxter was very much interested in this patent, and he came down to Luton, and so long as we carried out the patent everything appeared quiet and agreeable. I have been informed since that he was interested in it.

1612. Have you carried out the same system since that time?—Yes.

1613. And it is being carried out now?—Yes.

1614. At a cost of something like 500*l.* a year?—I believe that is correct.

1615. Have the board discussed at any time the propriety or otherwise of applying the sewage to land for irrigation purposes?—They have; the surveyor has stated the contrary, but I do not think he was present at the time. It has been in contemplation, although I do not think there has been any formal resolution upon it. I have gone a little into the subject myself, and I have an idea that about 500 acres of land would receive the whole contents of the sewers from this town.

1616. What is agricultural land worth in the valley below the town?—I think about 30*s.* an acre per annum.

1617. Do you think it would be possible either to lease or rent 150 or 200 acres?—Mr. Leigh owns the territory here, or Mr. Crawley; they own an immense quantity of land.

1618. Have you ever talked over with the board the propriety of providing a water supply for the town?—Yes. I have been an advocate for that all along, although there have been opponents to it on the board; but to the credit of the present board I may say that the whole of them consider it is a most important thing to have waterworks in their own hands. A company was started some years ago, but they have done nothing; they have had every encouragement, and they obtained an Act of Parliament, but it is a dead letter.

1619. If you could afford to supply any small tenement, or cottage dwelling, with as much water as they required from Monday morning to Saturday night for 1*s.* a quarter, do you not think it is very desirable to do so?—I should imagine that it could be done for that price.

1620. Then the poorest person would be extravagant to use a pump, and it would be dangerous to keep the pump in existence?—Yes.

1621. The Public Health Act gives you power to acquire a site upon which to erect waterworks; also the power of borrowing money and repaying it by annual instalments; it further gives you a compulsory power to supply every house within the district at a certain price?—Yes, if it does not exceed 2*d.* a week.

1622. (*Mr. Harrison.*) From the evidence of the surveyor as to the volume of water coming out of the sewers you have constructed it would appear that the

subsoil of the valley must be saturated with water?—I think it is.

1623. He stated that there were about 2,000,000 of gallons a day collected by the sewers; if that is the character of the chalk in the district I should imagine that by careful examination of the district higher up the valley there would be no great difficulty in conveying such a draught through the subsoil and collecting the water at such a height as to supply this town without any difficulty, and without pumping?—Yes, I should say so.

1624. The 2,000,000 of gallons a day which are delivered from your culvert close below Luton would be a water supply for a town a mile or two lower down at the rate of 100 gallons a day for your present population?—Yes.

1625. (*Chairman.*) Are there any gasworks in Luton?—Yes.

1626. Do they belong to the board of health, or to a company?—They belong to a company. I am a shareholder in it, and they have been very successful.

1627. Have you contemplated that they might be acquired by the local board?—Yes; and there has been a conversation upon that subject.

1628. Does the local board possess any property of any kind?—They only possess their own board room, which they purchased about eight or nine years ago. I suppose that that is worth about 800*l.* or 900*l.*; they also possess and occupy the land where the deodorizing works are erected, and which cost them about 950*l.*; they bought the land very cheap at the southern end of the town; it is valuable land; they possess the deodorizing works and the intercepting sewers which have been made.

1629. Have you, as a local board, any interest in the tolls taken at markets or fairs?—The board of health this year have purchased the lease of the tolls for 75 years, from Mr. Leigh, the lord of the manor, at a rental of 150*l.* a year.

1630. Will that enable you to construct a new market or regulate the markets which exist?—Yes; we have at the present time that matter under consideration; it is going on actively.

1631. Will it produce a larger income to your board if properly managed?—Yes, I am sure of that.

1632. Have you any baths or wash-houses for the use of the public?—We have not. There are in the town some public baths, which have been erected by a private individual, and they are just completed.

1633. Have the local board a public library?—No, they have not.

1634. Would not the Libraries Act enable you to establish a library?—I am of opinion that it would.

1635. What number of members constitute your board?—Nine.

1636. Is that number considered sufficient?—It is; but I think it is very small, comparing this town with other towns, for in some towns of equal size I apprehend there would be 15 or 16 members, and perhaps 20.

1637. What is the area within the jurisdiction of the local board in acres?—I do not know that, but Davis's "History of Luton" will, I think, give it.

1638. Did you attend the inquiry that was made by the inspector in the first instance?—Yes, I did, when Mr. Cresy came down.

1639. (*Mr. Harrison.*) Were the New River Company at all interested in the suit in chancery?—I could not say; but I have no doubt they were. I think the least they could do was not to press the costs upon us, and they did not. I am of opinion that it would be very much to their advantage if they would take this question up. I know that in London there is an idea that the water of that company is not good. I have read many chemical accounts about it; what may be the cause I do not know; we do our duty and we are satisfied.

1640. Have they assisted you in any way?—No; but I think they are bound morally to do so; they use the water; it goes on to Hertford, and then it goes into the river there. The river now is better than it ever was, and we strictly carry out the injunction.

1641. (*Chairman.*) You are acting within the four walls of the law, and you strive to do your best?—Yes; and we have done it.

1642. You are willing to do better if you can, but hardly know how to do it without incurring extra cost to the town?—I think the board would be willing to incur the cost if it was not an extravagant one.

1643. (*Professor Way.*) You have 500*l.* a year now to pay?—Yes.

The witness withdrew.

Mr. Kitt Tomson (Luton) examined.

1644. (*Chairman.*) Are you a surgeon residing in Luton?—I am.

1645. How long have you resided here?—For 20 years.

1646. Have you been in practice as a surgeon during that time?—Yes.

1647. Do you hold any public appointment?—I am medical officer to the board of guardians for the parish of Luton.

1648. What number of acres does that cover?—Nearly 16,000.

1649. Are you the sole medical officer for the parish?—Part of the hamlet has been taken off within the last week or two, but before that I was the sole medical officer.

1650. Have you anything to do with the town proper?—Yes, with the whole of the parish of Luton.

1651. Are you at all connected with the local board?—Only very occasionally.

1652. What type of disease is most prevalent in this parish?—We have every autumn sometimes more and sometimes less of typhoid fever.

1653. What should you, as a surgeon, say was the origin of typhoid fever?—It is partly owing to atmospheric influences, and chiefly owing to the quality of the water. I have stated this before.

1654. I suppose that over-crowded tenements, bad food, and exposure to bad weather, all conduce to it?—Yes; but typhoid fever has generally been found in my experience, which has been very great, and I have had it twice myself, principally in connexion with the drinking of impure water.

1655. Do you believe that that poisons the blood?—Yes; in fact, I believe that it introduces the poison itself.

1656. Typhoid fever is a blood disease?—Yes.

1657. The blood gets into a sort of ferment?—Yes. I believe that the poison acts as yeast does in beer.

1658. It is a zymotic disease?—Yes; at the present time I have amongst many isolated cases two which, to my mind, rather illustrate my position. There are in the town two blocks of houses separated by walls from any other houses, and the inhabitants of all those houses drink water obtained from the same well, and almost every inhabitant of those houses is suffering from fever at the present time. I have seen the water frequently, and I have observed repeatedly that after the slightest shower it becomes perfectly thick and unfit for human consumption. I have brought here a sample, obtained under favourable circumstances, of the water taken from one of those wells (*handing in the same*). I obtained it last night. I have not submitted it to analysis, but at the bottom of it you will perceive that there is a slight deposit.

1659. Having these fever cases under your care, and believing that the water is the cause of the disease, do you not think that this is a case into which those who have charge of the public health ought seriously to look?—I do.

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1660. Do you know the condition of the cesspits and the wells generally throughout Luton?—I believe that lately, when new buildings have been erected, the board of health has used every precaution, it is sometimes impossible to construct privies and waterclosets, and to provide the necessary ashpits, and so on, without the well water being affected. I believe that they have been exceedingly careful of late in doing that, but from the limited space they have to do it in it is sometimes very difficult.

1661. Do you know how near the well from which you have obtained the sample of water is to an adjoining cesspit or privy?—There is a large drain that conveys all the refuse from the house, and I think it is two feet away perhaps, not much more. The drain is just against the house; the yard is on an incline and slopes towards it; the ashpit is just at the top of the incline and the privy also.

1662. (*Mr. Harrison.*) How far are they from the well?—I think about as far as from here to that bench (*describing*).

1663. (*Chairman.*) Is it a pipe drain or a brick drain?—I do not know.

1664. Your opinion is that there is a communication of some kind between them?—Yes. I conclude that all the surface matter is washed into the well; there is leakage into the well in that case as in other instances.

1665. Are those wells at any time cleaned out?—I am not aware of any instance where they have been cleaned out, except where they have required to be deepened, which in dry seasons is sometimes the case.

1666. When the water falls off they sometimes deepen them?—Yes, and then a large quantity of muck is taken out that you could hardly stand by; two years ago I saw that done.

1667. Of what depth are those wells?—They vary according to the position of the town, but the well to which I have referred would be about 40 feet deep.

1668. Is a pump used to empty it, or is it drawn up by buckets?—It is drawn up by buckets.

1669. Is the top of the well open?—Yes. They have wooden lids.

1670. I suppose the water is slopped about at the top and may soak back again into the well?—Yes.

1671. (*Mr. Harrison.*) At what depth below the surface would the water be in a dry season?—Sometimes it is all gone; in the last dry season that we had nearly half of the wells in the town were empty.

1672. At what depth below the surface is the bottom of the well?—That varies; but from 6 feet to 60 feet or 70 feet, according to the position of the well in the town; it varies very much indeed.

1673. In what particular districts of the town, or can you give the names where there is generally the most fever?—During the greater part of this year it has been just beyond the township, at a place called Brown Brick; it adjoins, but it is beyond the town; it is just by the deodorizing works.

1674. Can you refer to any disturbing influences which exist there?—I should say it is from the same cause, the impurity of the water. The board of health have no jurisdiction there at all, and therefore all the disturbing causes are perfectly uninfluenced.

1675. Have not the parish authorities any jurisdiction there?—They have, and they employ an inspector of nuisances, who is very active; but, with the greatest respect to him, the fact is that he does not possess that amount of scientific knowledge which would enable him to detect impurities and so forth. As far as local nuisances are concerned he has been very active in the discharge of his duties, and has done a great deal of good in the last year.

1676. Within the town are there any places to which you can point where fever prevails?—I may allude to a spot where that water was obtained (*pointing to the sample*); there they have had fever for the last three months, and in fact it has never been out of the place. That is Queen's Square, which is nearly opposite the national schools, in the south-western part of the town. We had it about two years ago in the north-eastern part of the town, but that was a remarkable instance, that was before that part was drained. In one street almost every house had fever, but we have not had a case since the place has been drained. Most of those streets are admirably fitted for drainage, being almost all upon an incline. I may mention that we have been very much indebted to the wet seasons, which have flushed our sewers for us, and we have had less sickness rather in wet than in dry seasons. With regard to the ventilation of the sewers, I cannot quite agree with the surveyor, as the odour from the gully holes is in my opinion most offensive. I often go out at night when the influence of the sun has gone, and the smell from the gully holes is most offensive in a dry season. They are more so at night, especially along George Street. I frequently have the smell in my own scullery, which is connected with a main sewer, and I often have to pour down carbolic acid, and many other things.

1677. What material is used for bleaching the plait?—I will give you a list of them. The bleaching materials consist of oxalic acid, salts of tartar, salts of sorrel, pearl ash, and brimstone—all these are used in bleaching. In dyeing the two principal articles used are logwood and sulphate of iron. For the black they principally use cuba fustic, yellow wood, and camwood. Most of these are dyes obtained from the West Indies or South America, and are vegetable dyes. They use Brazil wood and indigo, blue paste, which is sulphate of indigo, and they use a small quantity of sulphate of copper; shumach is also used, and madder.

1678. (*Chairman.*) These materials when expended, we have been told by the surveyor, pass into the drains, and then into the outlet sewer. May they not filter in their course into some of the wells?—They may do that, and no doubt they do.

1679. Are any of those ingredients poisonous?—Yes, oxalic acid is a most powerful irritant poison, and also sulphate of copper, that is poison in very small doses. They use sulphate of iron principally, and sulphate of copper in a less degree.

1680. (*Professor Way.*) Do they not use chromate of potash?—I think not; I am not aware that they do.

1681. (*Mr. Harrison.*) Can you say whether the well you have spoken of, in the south-east part of the town, and from which you took the water, is dried up in the manner you have represented in the summer time?—I have a strong impression that it is, but I cannot state certainly. The greater part of the wells were dried up in the summer two years ago.

1682. Is there any information you can give us as to the health of the town of Luton at the present time as compared with its state in past years?—Yes. I may say that I have no doubt that what the board of health have done, both paving and sewering has very much improved the condition of the town; at the same time there is a great deal more to do. We are very much indebted to the board of health for what they have done. I may say that the state of the public health, in my opinion, would not be so well discovered in the actual mortality as in the condition of the health of the people, and the health of the people generally is of a higher tone, excepting in very bad seasons when many of them are very poor. In good seasons, however, their health has very much improved, and they are not so susceptible to all those little ailments which, in my judgment, are more characteristic of the general health of the town than the mortality, nor so susceptible to any of the more severe epidemics.

1683. (*Professor Way.*) The death rate is not an absolute guide?—I do not think it is; I think that that is rather too much insisted upon.

The witness withdrew.

Mr. W. D. SANDOE further examined.

1684. (*Mr. Harrison.*) Have you heard the evidence that has been given by Mr. Tomson?—Yes.

1685. You have supposed the volume of water issuing from your works to be about 2,000,000 gallons a day?—Yes.

1686. Do you find that that varies very much in different seasons of the year?—Yes, it does; that is the calculation now just at this moment; it has been a very wet time.

1687. What was the volume of water that passed out of your sewer during the dry seasons of 1864 and 1865?—I should say about half the quantity.

1688. Was it half the quantity?—I think so; our intercepting sewer, passing as it does through a very large portion of the valley, and cutting through several very strong springs, would, I think, be calculated to keep up a supply of water in our sewers more than would be found even in many of the wells of the town, on account of their being so shallow.

1689. Is there any considerable rise from the river up towards the town?—Some of the higher parts of the town are something like 70 or 80 feet above.

1690. Mr. Tomson stated just now that the wells in many parts of the town were sunk to the depth of 60 or 80 feet?—Yes, and some of them down to 90.

1691. When there is an abundance of water to what height would it rise in those wells?—Six feet is the outside quantity at that great depth.

1692. Do you think your sewers collect water from the chalk at all in the neighbourhood, or such wells as those spoken of?—No; the greater part of our water is nearer to our works, that is, the lower portion.

1693. The answer that you gave to the question put as to the flushing of the sewers by the large volume of water that is discharged through them is not, I suppose, applicable to the branch sewers leading to the upper parts of the town?—It is not.

1694. In those parts of the town where you have opened out the sewers to put in branches, what have you found to be the condition of the sewers?—They have been invariably clean on account of the rapid fall; they have all of them excellent falls in the upper part of the town.

1695. (*Professor Way.*) They get flushed by the rain, do they not, to a considerable extent?—Yes; and it must be understood that there is a very large quantity of water used in washing and bleaching and dyeing the plait, which would of course add very materially to the cleansing of those upper sewers; in many parts of Luton very many of these small dyeing places are to be found where a very large quantity of water is used.

1696. Your sewer evidently lets in a large quantity of water in the lower parts, but is it equally well constructed to let out water in other parts?—It must be understood that in the portion which I allude to especially, very great engineering difficulties were encountered at the time of making it, and that very strong springs were cut through, which, as I may say, formed the upper side of the sewer, or the hill side; the lower side was nearer to the river.

1697. The springs, as I understand you, were so violent in some cases that there was a difficulty in making the sewer so complete and so water-tight as in other places?—Yes, that was the case.

1698. May not the sewage water escape in the dryer parts of the town from your sewer into the subsoil, and so reach the well?—I do not think that that would be so in the upper parts of the town, because the difficulties which I have spoken of were not encountered there, and therefore the sewer would be better.

1699. Were earthenware pipes generally laid there?—Yes, in the upper part of the town.

1700. You can make pipe drains more water-tight than brick drains?—Yes, and I should recommend them in all cases.

1701. (*Chairman.*) Do the larger sewers or drains ever choke during a thunderstorm from there being too much water?—We have found that to be the case; but of late, or within the last two years, we have made a very large storm-water bed, which would cover something like an acre of ground, and that takes in the overflow and relieves our sewers very materially; we therefore do not suffer from flooding now.

1702. You have ventilators in your outlet sewer I believe?—Yes.

1703. How are those ventilators formed; are they mere openings at the surface?—Yes.

1704. Up to the open air?—Yes, with open gratings.

1705. Are you acquainted with the ventilators used in London, and which you may see on the surfaces of the streets?—Yes.

1706. Are yours of that kind; is there a cast-iron grating on the top?—Yes.

1707. In the ventilation of sewers are you aware that it is the upper ends of the sewers that require ventilating more than the lower ends?—Yes.

1708. That is to say, that gas runs up hill with the same facility that water runs down, and reaches the higher points?—Yes.

1709. Did you hear what Mr. Tomson stated about the sewers smelling most offensively in the night time?—Yes; but I have only heard one or two complaints of that. I do not wish at all to contradict what he said, but I only know that no official complaint has been made to me on that point.

1710. Are you inspector of nuisances as well as surveyor?—Yes.

1711. In what part of the town do you find the greatest number of nuisances?—In the outer portions of the town; in the south-east direction there are more I should say than in any other part.

1712. Do you know the locality where typhoid fever, as Mr. Tomson stated, is prevailing?—Yes, I know the part alluded to.

1713. In your inspections in places where fever has been prevailing, have you ever seen anything that, in your judgment, might account for it in any way; any accumulation of foul matter or contamination of the water?—Where I have seen anything of that kind I have ordered its immediate removal in all cases; I have sent our own cart at once to remove any nuisance that I might have found.

1714. Has it ever occurred to you that an empty cesspit might for the time being be more injurious than a full one?—Yes, and I have always taken the precaution to use disinfecting powder; we have used chemical disinfectants in very large quantities during this year to sprinkle over the surface, and prevent the smell which sets up, whenever a place like that is emptied. Another precaution that I have taken has been to send men with the disinfecting powder to sprinkle in the various yards in the town.

1715. You have done that during the last summer?—Yes.

1716. Was it done at any time before the last summer?—The board of health did not take this matter in hand until the present year.

1717. Have there been any cases of cholera in Luton?—Not that I am aware of.

The witness withdrew.

LUTON.

Mr. William Willis (Luton) examined.

Mr. W. Willis.

12 Dec. 1866.

1718. (*Chairman.*) What business are you engaged in?—I am a straw hat manufacturer.

1719. Where are your works situate?—The largest works in the town are situated in Castle Street. We have some small places about the town.

1720. What number of hands do you employ?—In the town of Luton I employ about 300.

1721. Do you bleach and dye the plait?—We bleach nearly all of it, and we dye it occasionally.

1722. What materials do you use in your manufacture?—In the bleaching part of it we use oxalic acid, and salts of sorrel, and salts of tartar.

1723. Does that list (*handing the same to the witness*) contain all the ingredients that you use?—Yes, I think this enumerates nearly the whole of them; we use oxalic acid and salts of sorrel to a large extent.

1724. About what weight of these materials do you use in the course of twelve months?—From one to two tons a year of oxalic acid and salts of tartar besides brimstone; that is a very heavy item.

1725. About what weight of straw do you deal with annually?—We bleach about 8,000 scores a week.

1726. Of what weight is a score?—I cannot say.

1727. What does a score mean?—It means 20 yards in length of plait.

1728. I suppose it varies in breadth, thickness, and width?—Yes; if it is of a light and single make the weight is lighter, if it is a heavy make of plait and double straw it is considerably heavier.

1729. About what weight of dyeing materials do you use?—We are but small dyers, but we have a large quantity of plait dyed in various parts of the town; we only dye to keep the men employed when they are not bleaching. I think that we use the weight I have given you in acids and salts of sorrel.

1730. What weight of brimstone do you use?—I cannot state at the moment.

1731. (*Professor Way.*) Is the brimstone burnt in order to bleach?—Yes.

1732. Do you burn the sulphur into sulphurus acid?—Yes; it is that which destroys the alkali in the plait and turns it white. I think I may say that we use half a hundredweight a week of brimstone; perhaps two tons weight of brimstone in a year.

1733. (*Chairman.*) Do you attempt to separate the solid portions of the bleaching and dyeing materials before the refuse is passed into the drains or sewers?—No, it goes off as refuse after it is done with altogether; they are all mixed together in a tub, a certain quantity of acid, a certain quantity of tartar, a certain quantity of sorrel are all mixed together when the plait is passed through it ready for the brimstone to be put to it; it all passes away into the sewers.

1734. (*Professor Way.*) What is the nature of that liquid, what is its appearance as it passes away?—The appearance of it would be a very dark brown colour.

1735. Irrespectively of the dye?—I do not speak of the dyeing, I confine myself exclusively to the bleaching. It probably depends upon the nature of the plait which passes through it, but there is always a very thick mud. Soap and soda are used in washing the plait, and after it has been cleansed it passes through the bleaching liquid to destroy the effect which the soap has had upon it in cleansing; it would be injurious if it remained in the plait; the final operation is the brimstone being ignited.

1736. (*Chairman.*) What volume of water do you use in the whole of your factories?—We pump it up by a steam-engine of three-horse power.

1737. What volume of water a day do you use?—It is purely a mere guess; we pump about four times a day for about three quarters of an hour as fast as we can pump, and I suppose we empty the cistern about twice a day.

1738. What is the size of the cistern?—I think we use perhaps 1,000 gallons of water a day.

1739. Does it all become refuse?—No, certainly not, a great part of it passes away as pure as water; the only refuse would be when we are dyeing or bleaching, such as the liquid which is used to cleanse the plait and the liquid which is used to put the bleach on. The wash which passes away from the closets and stables is the refuse, the other passes away, a great part of it, in an impure state and not at all diluted.

1740. What quantity of the 1,000 gallons would be polluted as you have mentioned?—I have no such calculation with me, but perhaps 300 gallons a day passes away, having been used for the purposes of bleaching.

1741. (*Professor Way.*) Is there anything in it that would make it worth your while to extract; is there any value in it?—No, it is not worth the trouble.

1742. Do you use much soap in your manufacture?—Yes, we use a large quantity of soap. You asked what was the colour of the refuse water. When we begin to use it it is very clear, but when they have finished it is not so.

1743. What arrangement in the shape of privy accommodation have you made for your workpeople?—Very bad indeed.

1744. Have you introduced waterclosets?—Yes, at the top of the building, and they are served by pumps. We cannot get the cistern high enough to supply them. We supply the cistern with a force pump and the labour of a man, but unless they are very much looked after there is a great deficiency, and a great nuisance is the result.

1745. You have to manage your own engine, supply your own labour, sink your own well, and do everything?—Yes.

1746. Do you think that the local board could perform that operation better than you would do it yourself?—Yes, very much better, and very much cheaper, and immensely to the advantage of our workpeople. The same remarks apply as to the number of the workpeople and the water, where there is a scanty supply, as applies to the houses where it is very difficult to get at it, and there is no doubt that that is one of the things which we so much need in Luton, where it forms the staple article of our bleaching operations.

1747. If you could be supplied with water as economically as a properly devised water company could supply to you, would you take it from them in preference to sinking for water yourself?—I should consider it one of the greatest advantages that we could have to be able to treat with a company or the local board to-morrow for a full supply of water to our premises at an additional cost of about 20*l.* or 30*l.* a year beyond what we pay now.

1748. And if you could obtain it at half the cost of your present supply it would be all the more satisfactory to you and do no one any harm?—Yes; it is always best to put these cases as strongly as justice will allow them to be put.

1749. (*Mr. Harrison.*) Can you give us any idea of the extent of your own manufacture as compared with the total amount of the straw hat manufacture in the town?—No, I cannot; it would be so very small as compared with the trade of the whole town that it would bear no comparison. Such is the extent of it all over Luton and everywhere.

1750. (*Chairman.*) Have you no idea what number of persons are employed in the straw plait trade, say within 1,000?—No; but there is a very large number of persons so employed, more than half the population; that is the best approximation I can make.

1751. Do you think that the refuse as it passes from your premises, and as it must go from others, containing ingredients like those which you have mentioned, should be carried into the river to pass on to London, and there to be distributed for drinking purposes?—No.

1752. Even after it has undergone the deodorizing process?—I do not care what process it undergoes, it comes from a population of 22,000 inhabitants. There is an immense quantity of logwood and all kinds of acids and other refuse from a town like this, and I say that it never ought to be allowed to pass into any stream, not even into a drain, much less into a small stream like the Lee, which sometimes has not five inches of water in it. Although we do not use it for domestic purposes, perhaps there are parties living within two or three miles of this place who do use it, and it must be, I should think, highly injurious to the health of the people in the neighbourhood.

1753. Are there among the chemical ingredients which are used for dyeing and bleaching certain poisons which remain so although they are diluted?—Yes.

1754. The poisonous character is not destroyed by the dilution?—No.

1755. (*Professor Way.*) I think you stated that dyeing was not carried on in large establishments, but that there were many small ones?—Yes. I should say that our dyeing is perhaps larger than in almost any other house in Luton; but dyeing is carried on by Mr. Leye, Mr. Tierney, and some five or six large dyers. We send it out, but there are many other small makers, such as would use 1,000 or 1,500 score of plait, and dye it at home; for instance, where a man and woman manage their own trade, if they dyed their own plait they might save a sovereign by doing it, and all these things help to make up an income during a week. Therefore there is a great quantity of dyeing done all over Luton, and I think that it exceeds the bleaching considerably, especially for several months in the year. You may have observed places of business in George Street, but scarcely any of them dye. All their goods are dyed at various parts of the town. The plait is bought in its rough state on a Monday, the parties work it up, and bring the hats down to the market to sell them. We keep a large number of hands, and we send our plait off to be dyed; but we do it ourselves for a few weeks in the summer when we have no bleaching going on, just to employ our bleachers.

1756. If it were possible in your manufactory to do anything to purify the refuse before it was sent into the sewers it might not be possible to do so in very many small places?—I think not; it is not as if these operations were confined to particular parts of the town where you could deal with them in bulk.

1757. (*Chairman.*) Where does the plait which you make in Luton go to to be used?—The best plait is not made in the town. Some little is made in the neighbourhood, but most of it is made 10, 15, or 40 miles away from Luton; it is brought here from Dunstable and other places to go through the process of bleaching and dyeing, and then to be manufactured into white or black hats, or white bonnets, or black bonnets. There is a large market here on Monday morning, when we buy the materials that are brought to Luton to be made into the manufactured article.

1758. It is used in England?—The manufactured article is used all over the world; it is sent abroad and goes to every place on the continent of Europe; to the United States, Valparaiso, Chili, Brazil, and everywhere else wherever there are ladies.

1759. Do you know, as a manufacturer, whether the same kind of material is imported from any other part of the world into England?—Yes, we import very large quantities, and so do our neighbours the French, from Saxony and Switzerland, and the Duke of Baden's estates. I mean not the manufactured, but the raw material, the straw.

1760. The plait?—Yes.

1761. Is there any importation of manufactured articles, hats or bonnets, from any part of the world into England?—Very few are imported. Sometimes a few from France and Belgium, but there are more bonnets come from France. From Belgium they are very limited. These are bought in this country more to ascertain the style of the article made in those countries, and when we have got that we can beat them by half the price.

1762. Shall we be right in saying that England is a straw bonnet making country in this part of it?—Quite so, and that it beats all other countries in the world.

1763. What is the youngest age of the children who come into the business?—That question must be divided into two parts; first, as to the age at which we as large manufacturers should be disposed to take them, and, secondly, the age at which large numbers are employed in small houses all over the town.

1764. And all over the county, or the straw plait district?—Yes, that is a very different affair. I should never think of taking a young child. The boys come to us at 10 or 12 years of age, and then we have no objection to take them; but there is no doubt that very large numbers of children are employed at a very tender age in the making of straw hats in various parts of Luton and in the counties adjoining.

1765. At as early an age as the little fingers can do any work?—I should certainly say from eight years upwards.

1766. Is the business at all under Government inspection?—No; for this reason, that the Government seldom interfere but where masters bring large numbers of workpeople together on their premises; they have seldom interfered where a woman having two daughters of her own may choose to engage two or three more persons to work in her own house; that, I think, is one reason why we are not under Government inspection.

1767. Have you any regulation with regard to what are called half timers or scholars?—While I lament that persons so young should be engaged in any manufacture, or in any employment at all, instead of their youthful days being devoted to education and to those advantages which they can only have in early life, I do not think that this employment is injurious to their health, because they are allowed to go out very frequently and to walk about; they are not in heated rooms; they would suffer considerably more in rooms of that character, where large numbers are brought together, than they do in those houses. I express my regret that they are employed at all, but in justice to the parties who do employ them, I am bound to say that I think that considering the pure air which they get in going to and fro and often running about the yards, the employment is not so injurious as if they were brought in large numbers into one building.

1768. I assume that the making of straw plaits is, during a considerable portion of the year, carried on even by the children in the open air?—It is.

1769. And therefore they breathe the fresh air?—Yes, and I do not think that it is so injurious to their health as we should suppose at first sight. My objection is that which I have stated.

1770. Therefore they do not come under the same range of objections as factory children confined from early infancy within the four walls of a building?—No. I must make one more observation, namely, that there is a great alteration as to the time for which the people work here. In the large manufacturing districts there are fixed hours; persons must be there from 6 o'clock to 6 o'clock, and another party comes on and remains till the others return; the way in which the business is conducted here is, our young people come at 9 or half-past 9 or 10 o'clock, and they go away at a quarter to 12, stay away two hours, go to and fro, except on particular occasions, and do as they please.

LUTON.

Mr. W. Willis.

12 Dec. 1866.

1771. (*Mr. Harrison.*) It is all piece work?—It is all piece work.

1772. And there is no machinery standing?—No; and there is none of the noise made by clogs which there is in the north of England.

1773. I presume that in the manufacture of plait there is some advantage in early teaching?—There is an advantage, but we must not purchase any advantage at the expense of one's whole life afterwards.

1774. (*Professor Way.*) Perhaps it is an advantage to the proprietor rather than to the people?—Yes; it is not an advantage to the younger children. You will find within four or five miles of this place that which I think is more injurious, namely, 18 or 20 young children brought into a woman's house, and in a very small room, where the cooking and so on is going on, and she perhaps gets 2*d.* a week for each of those children from their mothers, and extracts from them a certain quantity of plait every day. I think that the plaiting children suffer considerably more than the children do who are employed in various parts of the town in making up the hats.

1775. (*Mr. Harrison.*) Instead of being educated they are at work?—Yes, and that is my great objection. At the same time I cannot but think that it is highly injurious to bring 20 little children into the first floor of a small cottage, and for them to sit there until 9 o'clock in the evening, at the tender ages of eight to 11, making a certain quantity of plait. If we had Government inspection in this neighbourhood I think that the plaiters would need it more than the straw hat makers.

1776. (*Chairman.*) I gather from your remark relative to the clogs in the north that you have heard them?—Yes; they wear thin shoes here, slippers and all sorts of things.

1777. (*Mr. Harrison.*) You have given us a description of the materials which you use, you have also stated the number of people whom you employ in your manufacture, and the volume of water which you use; can you give us the weights of those different materials which you use per annum in bleaching?—I can do it, and will enclose it to the Commissioners.

1778. With respect to Dunstable I wish to ask you a question?—We have a factory there.

1779. Is the manufacture there of a similiar character to that at Luton?—No, it is altogether different.

1780. What is the difference?—There it is principally, if not wholly, confined to manufacturers, and it is not carried on, as it is here, to a very large extent by small makers.

1781. Is the straw there bleached and dyed in the same way as it is at Luton?—Yes, if it is bleached and dyed at all, but large quantities are dyed here and taken to Dunstable and various other parts; bleaching and dyeing is carried on to a very limited extent in the town of Dunstable.

1782. Dunstable is not so happily situated as Luton for a good supply of water or for getting rid of the refuse which you mention as the result of the manufacture at Luton?—We are bad, but they are worse.

1783. (*Chairman.*) With regard to Hitchin, what branch of the business is carried on there?—We have a small factory there of 50 hands, and there may be a few besides; there are, perhaps, not more than 100 hands in the whole place; therefore it is what we should call a large market town, situated in an agricultural district; it is a very large straw plait market in the raw material. I am speaking now so far as the conversion of that straw plait into the manufactured article is concerned.

1784. Where is the straw principally grown?—Throughout the counties of Hertfordshire and Bedfordshire, some in Buckinghamshire, and immense quantities in the counties of Essex and Suffolk.

1785. What is the straw?—It is the wheat straw; it is much superior in this part to any other, and although an immense quantity is used in the county of Essex, immense quantities of that straw are sent down there for the plaiters to use, because it is of a softer kind. I know not what is the cause, but the neighbourhood of Tring, Biggleswade, and the county of Berks are very excellent districts for the wheat straw, which in times of scarcity is brought here.

1786. (*Mr. Harrison.*) Is it generally grown upon the chalk formation?—Yes. Biggleswade and this county is a very excellent neighbourhood for straw.

1787. (*Chairman.*) Is the straw which is purposed to be used for plait reaped in the same way as ordinary wheat, or with more care?—If a farmer has a small quantity where he thinks the straw is very superior, it is to his interest to be very careful in cutting it; we do not like straw which has been mown; it should be reaped, and if reaped it may be reaped in the usual way, and then it goes into a machine. Persons come and buy a stack of wheat and give the farmer money, according to its value, for the stack of wheat; that is taken into a machine; the parties there are cautious to draw the straw out and they put it up into small bundles; they cut off the ear, bringing the other part away.

1788. The wheat is not thrashed as ordinary wheat upon the floor or in a thrashing machine?—No.

1789. But the ear is cut off?—Yes; if you buy 1 or 2 cwt. it is all weighed together, and you leave the wheat behind and any refuse; if the straw was at all broken it would not be at all suitable for making straw plait.

1790. (*Professor Way.*) Is not that the way in which the harvest is reaped in America?—I have so little knowledge of that democratic country that I cannot speak as to that.

1791. (*Chairman.*) Do you know of your own knowledge whether the straw of wheat which has been grown under good and improved cultivation is better in quality for your straw plait than neglected or poor wheat?—The neglected wheat is better for our straw because it is finer; if the cultivation is too much improved, and the crop is too heavy, the straw is too coarse for us, and therefore we get the light straw from the poorest parts, and sometimes from the poorest farmers.

1792. (*Mr. Harrison.*) I think that the character of the chalk straw would generally be short, fine, and white, which are your essentials?—Yes.

1793. (*Chairman.*) In your opinion would the straw of Russia, or of the great wheat-bearing districts of the continent, from which we mostly get our corn, be equally available if sorted for your purposes?—No plait is made in Russia, and therefore I cannot speak to that; but you get straw in Belgium quite equal to our own, and some kinds of straw in Switzerland quite equal to our own, and in Saxony also.

1794. And in Spain?—I know very little of that country.

1795. Did you ever see any Australian wheat or Australian straw?—I have not seen Australian straw I have seen Australian wheat.

1796. Of course it would not be worth while to import straw from Australia?—No, it would not pay if you gave it to us. When our trade is brisk the beauty of it is that it is all labour. If I showed you a lady's bonnet, worth 7*s.* or 8*s.*, the straw in a farmer's yard would not be worth a penny, and therefore all that is labour.

1797. (*Mr. Harrison.*) There is labour and profit?—Yes.

1798. Is the Leghorn straw plait made from wheat straw?—I suppose that it would be a wheat straw, but it is differently prepared, which gives it a different colour.

1799. Are Luton and Dunstable the centres of the straw manufacture?—Luton and Dunstable are the emporium of the manufacture of straw hats and bonnets.

1800. What is the extent of country over which the manufacture of straw spreads?—About a radius of 25 miles round Luton I should think would be engaged in the manufacture of straw plait and straw goods.

1801. (*Chairman.*) Have you any idea what would be the gross sum, within a few thousands per annum, which is turned over in this straw plait trade?—No; it is more than 1,000,000*l.* per annum. There are single houses which do more than 100,000*l.*

1802. Then it is a very important trade for this part of the country?—I think so. If I said 2,000,000*l.* I should not have any doubt about it, but I should not like to say, because when persons speak with that minuteness they are apt to form their judgment in detail and pass their criticisms upon men who know more about the matter than themselves.

1803. But you think that the gross sums dealt with may be taken at from 1,000,000*l.* to 2,000,000*l.*?—Yes.

1804. Is it an increasing or a decreasing trade?—A largely increasing one. You may fairly take it for granted without any mistake that the amount is between 1,000,000*l.* and 2,000,000*l.*, and, in the opinion of a gentleman who has just spoken to me, considerably nearer the latter than the former.

1805. (*Mr. Harrison.*) Can you give any idea of the total weight of straw which is used in the manufacture?—No, I could not approximate it at all.

1806. (*Chairman.*) Is there anything you wish to add?—No.

The witness withdrew.

Mr. John Cumberland (Luton) examined.

1807. (*Chairman.*) You are a land surveyor?—Yes.

1808. Were you at any time surveyor to the local board of health?—I was surveyor on its first introduction into the town about 16 years ago. I was surveyor to it for five years.

1808*a*. Had you anything to do with devising the system of sewers?—Yes, I laid out several new sewers.

1809. When you were first surveyor?—Yes.

1810. In what condition did you find the town upon your appointment as regarded sewerage and drainage?—The whole of the new streets were entirely without sewers. There was an old sewer down George Street and Park Street.

1811. Of what shape in section were the old sewers?—They were near the surface of the ground, and they were 12-inch sewers, except the one in George Street, which was 15 inches.

1812. Were they square on section, or circular?—Circular.

1813. Were they made of brick?—Yes.

1814. I suppose that they had been made by the highway surveyors for carrying away the surface water?—Yes.

1815. Did they at that time drain any of the houses?—Yes, the surface water, but not the cellars or underground kitchens.

1816. Were the contents of any waterclosets at that time turned into those old drains?—There might be a few, but I think not 20 in the town.

1817. Where did the old drains empty?—Into the river Lee or into the ditches which went into it.

1818. How long have you known the Lee?—25 years well, and longer.

1819. Do you know where it rises?—I think that I know every point of it.

1820. Does it rise principally in springs?—Yes, in a series of springs at Leagrave Marsh.

1821. Have those springs been at all interfered with within your knowledge by any parties?—Yes.

1822. Who has interfered with them?—The farmers from time to time have filled in the springs as they ran into the land and interfered with cultivation; they have filled them up and then ploughed over them.

1823. They would not stop the water by filling them up?—They would divert it.

1824. When a spring goes into daylight, if they filled it up it would go out of daylight?—Yes.

1825. Have you seen any land irrigation anywhere?—No, not sewage irrigation.

1826. Have you seen any water irrigation?—Yes; I was on Lord Dacre's estate as a pupil.

1827. From your knowledge of water meadows do you think that a beneficial effect might be produced by sewage irrigation?—Certainly.

1828. What weight of grass were you enabled to get from your water meadows?—I cannot say, because the land was always fed with sheep.

1829. It was considered advantageous?—Very advantageous.

1830. That was pure spring water?—Pure river water, the water of the river Mimram.

1831. In what district is that irrigation carried out?—About seven miles from here.

1832. Below or above?—It is in Hertfordshire.

1833. Is it down the river Lee below Luton or above?—It is on the river Nene, which falls into the river Lee at Hertford.

1834. What is the subsoil, is it chalk or lime?—Gravel; and not chalk.

1835. That is the land which you irrigated?—Yes.

1836. What did it cost per acre to lay out that land for irrigation?—I cannot say; it was done before I went there.

1837. Had it been a costly affair?—No; it was done by a series of side cuts and side drains falling one into the other; it was very simple.

1838. Do you think that you could readily with a plough lay out irrigating grips by contour lines so as to irrigate land in a similar way?—I have no doubt that arable land could be done so at very little cost.

1839. (*Mr. Harrison.*) Was there any difficulty in getting the water to pass over that character of soil?—No; it was blocked up and run out of the main river on to the beds, and it then flowed into the river again lower down.

1840. There was no difficulty from its soaking into ths soil too rapidly?—No.

1841. (*Chairman.*) What is the general character of the soil of the valley of the Lee?—Chiefly chalk; there is a little bit of gravel first of all, a kind of silt, and then you get into the chalk; but lower down beyond here I should say that you get into very boggy peaty land, that is in the lower valley close to the river, but as soon as you get away from it you are in chalk.

1842. I think that there is a new railway being made up here?—Yes.

1843. And that shows you that the soil is chalk for several miles?—Yes.

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1844. The excavations are chalk, and of course the embankments are chalk?—Yes; I should say that in the cutting at Chalton Cross, just at the source of the Lee, they are tapping springs, and they are in water the whole time; the Midland Company are about 55 feet deep in cutting and they have been flooded with water the whole time, and are now; I was there on Saturday.

1845. (*Mr. Harrison.*) Is that cutting at a considerable elevation, considerably above Luton?—Yes; it is gradually rising the whole way.

1846. How many miles distant is that cutting?—About $3\frac{1}{2}$ or 4 miles.

1847. Would that volume of water which has been passing from the sides of the cutting afford a good water supply for the town of Luton?—Not at all, but it would certainly aid it very much.

1848. You have said that you carried out the sewerage works of Luton?—Yes, the earlier part of them.

1849. Did you find any difficulty in any part of the town in executing those works efficiently in consequence of the springs of water which came into your works?—No; we never got into the lower level.

1850. In the works which you did carry out did you tap springs to any extent?—Never to any extent.

1851. How many miles of main sewers were executed under your inspection?—I think probably not above a mile or a mile and a half.

1852. (*Professor Way.*) What is the usual value of land in this district for general agricultural purposes?—From 30*s.* to 2*l.* per acre.

1853. It is not a good wheat district, is it?—I think very good.

1854. You think it very fair?—Very fair.

1855. Then what has caused the straw plait, which requires an inferior wheat although a superior straw, to locate itself here?—A high state of farming has driven the straw trade into an inferior farming district.

1856. In the north we have heard that the manufacturers have gone to certain districts for pure water for dyeing and cleansing purposes; what do you imagine originally caused the straw plaiting business to settle itself in this district?—The quality of the wheat straw unquestionably.

1857. And that, we have been told, is not a fine quality of straw agriculturally?—Not agriculturally.

1858. Then is the land about here under the average of good fair land?—No; I should think that it is a very fair average, taking the country through.

1859. Straw fit for plaiting is only, I suppose, to be found on certain soils?—Yes, the best quality of straw, namely the softer quality of straw is on the green sand formation.

1860. If you found that on a particular farm a large quantity of straw was bought for straw plaiting purposes, would you suppose that that land would sell for more or for less than other land in the neighbourhood?—It would not affect the value of it in selling at all.

1861. We have been told that the poorest wheat gives the best straw?—That is quite correct. If you go to Totternhoe, the next parish to Dunstable, where they grow the best straw, it is open land, and they grow more straw than wheat, but it is a risk; if a shower of rain comes it is spoilt unless they do it at the right moment, but it answers the purpose where your farming is not up to the mark, and if they can get the straw they cut it very early; they sacrifice the wheat in order to get the straw.

1862. (*Mr. Harrison.*) In the case of the irrigation which you mentioned just now did the water issue from the green sand?—No, it came from pure chalk, the white wells, near Whitwell, Herts.

1863. (*Professor Way.*) Do you know whether any coprolites are got in this neighbourhood for manure?—Not nearer than Hexton, about seven or eight miles from here, over the hills; they are working them there very largely; they restore the land.

1864. Are they at any depth under the soil?—About seven feet. This specimen of a shell which I now produce came from Shillington.

1865. (*Chairman.*) Have you many of this form of shell?—Yes, a good many of them, not so perfect as that; I picked that out as being perfect.

1866. (*Mr. Harrison.*) Do you know whether the water issuing from the formation in that district is used for irrigation to any great extent?—Not at all, I think.

1867. Are you aware that it is very valuable for irrigation?—I was not aware of it.

1868. The beautiful water meadows of Dorsetshire and that neighbourhood derive a great deal of their superior quality from the water issuing from the green sand formation?—I was not aware of it; I do not think that it is used at all here; I am not aware of any case in the neighbourhood where we irrigate.

1869. (*Chairman.*) Is there anything further you wish to add?—No.

The witness withdrew.

Mr. C. Maffey.

Mr. Charles Maffey (Luton) examined.

1870. (*Chairman.*) You are the local registrar?—Yes.

1871. And you are sanitary inspector under the local board?—For the board of guardians in the hamlet, not in the township of Luton.

1872. Can you furnish the Commission with the local death rate for any period?—In the year 1864, in a very dry summer, we had a great excess of deaths.

1873. Could you extract from your books the mortality for the last five or six years?—I could.

1874. Could you give it to us for seven years before the board came into operation?—Yes.

1875. From 1845 to 1852?—Yes.

1876. And then from 1858 to the present time?—Yes.

1877. About what would be the cost of doing that?—It would be very trifling.

1878. I think that it would be best if we could get it from 1847 down to the present time. What has been the death rate per 1,000 for the last 12 months?—I should think that taking the 12 months it is 25, but in the dry summer which we had a year or two ago the mortality was greater on account of their being a short supply of water.

1879. What was it then?—I should think 35 per 1,000.

1880. Could you give us the death rate of different parts of the town?—I do not see very well how I could do that.

1881. In your experience is not the death rate in the poorer parts of the town, at a very much higher amount than the death rate in the better parts of the town?—Yes.

1882. If you have 10 in the 1,000 or 12 in the 1,000 in the better parts of the town, you may have 40, 50, or 60 per 1,000 in the poorer parts of the town, taking population and death rate?—There is no doubt of it; it is considerably greater.

1883. Therefore, when you sum it up all together, in a population of 20,000 it gives you a very poor idea of

what one part may be suffering as compared with another?—Yes.

1884. What was your worst year?—The year of the dry summer, which I think was 1864.

1885. If you will give us the part of the town where it occurred it will be of real use?—We can do that.

1886. (*Mr. Harrison.*) Are you the registrar of any country district as well as of the town?—Yes, I am registrar for this union.

1887. Could you give the death rate in some of the outlying agricultural parts of the district?—I think that I could give it to you from parishes in my district; my district comprises five other parishes besides Luton.

1888. Do you find a very great difference in the death rate of some of those outlying parishes as compared with the town of Luton?—No.

1889. (*Chairman.*) But a death rate of 35 in the 1,000 must have been frightful?—Yes, but that only occurred, I think, in one dry summer. In 1864 and at the beginning of 1865 the water was very insufficient.

1890. Will you add to the return which you are about to give us the death rate of some of the outlying parishes?—I will.

1891. (*Mr. Harrison.*) How are the outlying districts supplied with water?—At Stopsley, which is two miles from here, I do not think there is more than one well in the hamlet, and they got their supply of water from the clay pits and the ponds till at last the water was completely gone, and they were obliged to have their water from the river Lee.

1892. The water which they had was water collected from the surface into ponds?—Yes.

1893. Was there much vegetable growth in those ponds during the dry seasons?—Yes.

1894. Could other pollutions get into those ponds?—Yes, all the refuse from the roads and everything.

1895. Was the condition of those ponds, while the inhabitants were drinking the water, very bad?—Yes.

1896. Was the effect upon the health of the people who were drinking that water marked?—Yes; we had more deaths in that hamlet at the time when the water was bad and short.

1897. Do some of the villages obtain their water from wells?—Yes.

1898. Have they an abundant supply of it?—Yes, I never heard of the water failing in the villages about, but only in the hamlet of Stopsley, which lies on a hill and where they have no wells.

1899. Are those wells in the chalk?—Yes, all but Barton, and that is on the clay.

1900. Do you find much difference in the health of the inhabitants in those parts as compared with the others?—They have been more healthy and are so at the present time; the water has been superabundant.

1901. Will you let the returns which you give be of two parishes, one of which is situated in a chalk district with an abundant supply of water and the other a parish which is dependent for its supply of water upon the rain water collected in ponds, as you mentioned in the first instance?—Yes.

1902. You are inspector of nuisances?—Yes, for the hamlet.

1903. Not for the town?—Not for the town.

1904. You are appointed under the board of guardians?—Yes.

1905. How long have you been appointed?—I have been inspector of nuisances for many years.

1906. Have you found in the country districts occasions to call upon people to remove nuisances?—A great many.

1907. What has been the character of those nuisances?—The overflowing of waterclosets and bad drainage and so on. There was no sewerage to take it away, and the sewage soaked into the ground.

1908. Have you found any difficulty in obtaining the removal of those nuisances?—I have in some cases; I have summoned several parties before the magistrates.

1909. What system have you found in the country districts the best to adopt so as entirely to remove all occasion for complaint?—The only thing which I can find in the country districts is to have a privy, and to have it properly cemented to keep out the water, and properly covered in.

1910. And to have the refuse frequently removed?—Yes.

1911. Is it generally applied to the land?—Yes.

1912. Have you found any nuisances arising from the refuse from the farmyards?—No.

1913. You have not had any occasion to complain of that?—No.

1914. Have you found pigstyes kept by the cottagers?—Yes, and I have had them removed 20 or 30 yards from the houses.

1915. Have you found much opposition on the part of the occupiers?—No. I leave the proper notice, and it is done within the time, and if not I have been obliged in a case or two to summon them, but that is not a common occurrence. Brown Brick is the worst place which I have in my district.

1916. Is that towards the south-east part of the town?—Yes.

1917. Just outside the jurisdiction of the local board?—Yes.

1918. Did you hear Dr. Tomson's evidence?—I did.

1919. Do you corroborate it?—I do. A great deal of refuse lately has been thrown direct into the river Lee; it does not go into the deodorizing works. There have been many cases in the last few years of little bleachers and dyers, who have no drainage to take away the refuse, throw it down on the surface, and it is washed into the river.

1920. How did that locality happen to be without the district of the local board?—I do not know.

(*Mr. Pledge.*) That land has recently been sold for building land and a great population has grown up there, but it is outside the township.

1921. (*To Mr. Maffey.*) Is that a part of the town which has been recently drawn upon?—Yes; and I have seen two or three wells, the water of which was not fit to drink, and I have ordered them to be cleaned out; in fact there were places where a dumb well and a well of water were within a short distance of each other; I have had the dumb well filled up.

1922. Dr. Tomson said that there was evidently sickness arising from that state of things in that locality?—Yes.

1923. Is that likely to spread into the town of Luton?—Yes, it being so near.

1924. (*Professor Way.*) Those dumb wells are cesspools?—Yes.

1925. In what soil are they?—Chalk.

1926. Is any attempt made to prevent their leaking?—No; they make them here on the chalk so that the matter may sink away.

1927. Then what chance have the wells?—It drains through the chalk. What is called Brown Brick is not all chalk, it goes through the chalk and the gravel.

1928. They are never emptied?—No.

1929. It must go somewhere?—Yes, and it runs into the drains, and many of them go into the river; in fact drains have been laid from them into the road.

1930. Although the sewage of a house may not go into the river by the regular authorized drains it may get there sooner or later through the chalk?—It cannot help itself.

The witness withdrew.

LUTON.

Mr. W. H. Higgins.

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Mr. W. H. HIGGINS (Luton) examined.

1931. (*Chairman.*) What are you?—A plait merchant.

1932. Where are your works situate?—In George Street.

1933. What number of hands do you employ?—I am a dealer in the raw material.

1934. What quantity of materials in value passes through your hands in the 12 months as a dealer?—It is a difficult matter for me to tell you exactly; there are so many things which we deal in besides the raw material that I could not tell you, the raw material would be one particular branch.

1935. Did you hear Mr. Willis give his evidence, who stated that the whole amount of straw plait weight come to nearly two millions?—I have not the least doubt that it would exceed a million.

1936. And that this district is the greatest straw plait place in the world?—Yes, and this town has the greatest amount of straw plait.

1937. This town of Luton is the centre of that district?—It is.

1938. And it has the largest dealings in it?—By far.

1939. Are there any special points in this inquiry to which you wish to speak?—I wanted to put one question to you, you have been told that a private company has been formed to erect waterworks in this neighbourhood.

1940. Or has been spoken of?—Yes, that is two years since; they have done nothing yet. I wanted to know whether that would be a legal obstacle in our way as a board in erecting waterworks ourselves, as the company have done nothing?

1941. It would not, but if you allowed a company to occupy the ground, and to acquire legal rights of any kind, it would then be very difficult for you as a local board to get past them without purchasing them out.—They have not purchased any land at present, I believe.

1941*a*. (*Professor Way.*) Have they an Act?—Yes, they have obtained an Act.

1942. (*Mr. Harrison.*) What is the period within which they must execute their works?—Seven years, of which two years have gone.

1943. (*Chairman.*) I do not think that the Secretary of State would allow them to stop you if you put the case fairly to him. You as a local board would have to make application through the Local Government Act Office to the Secretary of State for Home Affairs, to be allowed to raise the money for your waterworks, and you would have to devise waterworks. Was this company going to sink a well?—Yes.

1944. Then I have no hesitation in saying that, under those conditions, the Secretary of State would not stop you, and I speak as the principal inspector of the Local Government Act Office. Very probably the question would have to be submitted to myself.—I am obliged to you. There is another question. You have heard of the state of the hamlet, which has formed part of the town although not in the township, and which is not under the board of health; would there be any difficulty in getting that hamlet under the management of the board of health?

1945. None whatever.—It is a great nuisance to us as a board.

1946. Your clerk ought to have been able to acquaint you with what the proper process would be. You would have to petition the Secretary of State to be allowed to extend your boundary, and if the Secretary of State, upon a report laid before him, approved of it, that extension would be made by a provisional order, at no cost to yourselves excepting it was opposed in Parliament?—I am obliged to you.

The witness withdrew.

Mr. T. Taylor.

Mr. THOMAS TAYLOR (Luton) examined.

1947. (*Mr. Harrison.*) You are bailiff to Mr. Crawley?—I am his agent.

1948. Where are Mr. Crawley's estates situated?—They are situated on the north side of the town of Luton, on both sides of the river Lee, extending for a mile and a half or two miles.

1949. Is that part of the river Lee at all subject to be flooded?—Very often.

1950. Has that flooding increased of late years?—I cannot say that it has, but there is an impediment which we consider might be removed. Formerly there was a mill on the north side of the town but now it is pulled down, and in the construction of the Midland railway they have put in a weir to keep up the water to its old driving height, which we consider is not of use to anyone. Formerly it was obliged to be at that height for the purposes of the mill, but now it is not required.

1951. Did the Midland Railway Company purchase the mill property?—Yes.

1952. Then with the mill they purchased the right of maintaining the dam?—I cannot say that.

1953. Would they not have to purchase the power of the mill when they purchased the mill, and the power could not be maintained without the dam, and therefore they would purchase the right to maintain the dam which the miller had before?—We consider that it overflows now perhaps rather more than it did before; for this reason, formerly when they found a flood coming on they could pull up their floodgate, but now they have none, and we consider that it floods our land six inches more than it did formerly.

1954. Have the Midland Railway Company done away with the mill?—Yes.

1955. (*Chairman.*) It is a common law right. We can listen to what you say, but I do not think that we can afford you any remedy?—By having this weir put in the water runs six inches deeper, and it floods the land all over its banks.

1956. (*Mr. Harrison.*) But you have said that the land is not flooded more than it used to be?—It is said that the amount is the same, but we consider that the land must be more flooded.

1957. (*Chairman.*) As I understand you, this is the fact which you wish to put before this Commission, that the Midland Railway Company have possessed themselves of a mill?—Yes.

1958. And have removed the wheel?—Yes.

1959. And have removed the mill?—Yes.

1960. They maintain the dam at the original height?—Yes, at the driving height.

1961. But they have put in no bye-sluices to enable them to draw down that water in time of flood?—Not at all.

1962. The miller had bye-sluices which he could draw, and did draw, in time of flood?—Exactly so.

1963. Therefore you may in flood time be more flooded than when the miller had possession, because there is no bye-sluice to be put in operation?—Just so.

1964. That is what you complain of?—Yes.

1965. (*Mr. Harrison.*) Have they lengthened the weir at all?—I should say not. The stream which leads up to the weir is narrower than the former bed of the river; it is about half the length of the former river. Formerly there used to be a large mill-head.

1966. (*Chairman.*) I suppose that you are not a solicitor?—No.

1967. But there is a solicitor belonging to the estate?—Yes.

1968. (*Mr. Harrison.*) Have the company erected a bridge above the weir across the Lee?—No, not across the Lee.

The witness withdrew.

Mr. Thomas Lye (Luton) examined.

1969. (*Chairman.*) What business do you carry on?—Dyer and bleacher of straw plait.

1970. Where are your works situate?—In New Bedford Road.

1971. What number of hands do you employ?—About 30; it varies.

1972. You dye straw plait?—Yes.

1973. Have you any idea what quantity you dye each year?—I have not kept any account of it.

1974. Do you know what weight of material you use in dyeing?—Yes; logwood is one of the chief things which we use in dyeing in this trade, because black is the prevailing colour.

1975. Is it chip or ground logwood?—Chip.

1976. What weight of logwood do you use?—I daresay that I use nearly 25 tons in the year.

1977. What becomes of the chip?—We burn it among our refuse.

1978. You do not send it down the sewers?—No, it is burnt.

1979. Do you use engine power?—No.

1980. What other material do you use?—There is a yellow wood called fustic, which we use in a smaller quantity.

1981. Do you use it in the chip?—Yes.

1982. Do you also burn that?—Yes.

1983. (*Mr. Harrison.*) What is the weight of that?—About two tons.

1984. (*Chairman.*) What other material do you use?—I use a few hundredweight of camwood; camwood is a perfectly red wood.

1985. Is it not red and yellow mixed?—There is an amount of yellow in it, but the main portion of it is red; it is called a red wood.

1986. It would be something like logwood?—It would be a deeper red. We also use madder; I should say four hundredweight.

1987. What else do you use?—I use copperas—that is sulphate of iron; I should think four tons in the year.

1988. Do you use sulphur?—I use it in the bleaching, but that has nothing to do with the dyeing, nor does it go down the sewer, as it is used in a gaseous state; I also use about two hundredweight of sulphate of copper per annum; and sulphate of indigo, perhaps five hundredweight per annum.

1989. (*Professor Way.*) What is it worth?—It is a sort which would be worth 1*s.* 6*d.* per lb.; there are different prices. We use four hundredweight of Cudbeer's article; also oil of vitriol.

1990. (*Chairman.*) How much oil of vitriol do you use?—Four or five hundredweight per annum.

1991. (*Professor Way.*) Do you dye anything but blue and black?—I dye various colours.

1992. What other colours do you dye?—Brown and different shades of drab.

1993. Do you use any of the fancy colours in aniline?—Yes, we use a small quantity of that; there are a number of little articles.

1994. Like this (*showing a specimen*)?—Yes; you would get this from the aniline dyes, but very little of the fancy colours is used in this trade.

1995. Do you use crimson or scarlet?—Yes, but the prevailing colour is black, a small quantity of brown, and a very small quantity of the others; we also use bleaching articles.

1996. (*Chairman.*) What are they?—Oxalic acid and salts of tartar. I do not do any large quantity of bleaching.

1997. About what weight of oxalic acid do you use?—About five hundredweight.

1998. Is it not a deadly poison?—We use carbonate of potash, and where a great quantity is used it neutralises it.

1999. (*Professor Way.*) But it makes the liquid into a poisonous salt?—We weaken it very much in the process by dipping the plait in it; we also use a small quantity of sorrel.

2000. (*Chairman.*) Have any accidents occurred upon the works from these poisons?—None whatever.

2001. What numbers of scores of plait do you treat in the year?—From 15,000 scores a week; perhaps 20,000.

2002. From 15,000 to 20,000?—Yes.

2003. A score being 20 yards?—Yes.

2004. (*Professor Way.*) Are there a great many sizes of plait?—Yes, there is a great variety; some very broad and some narrow.

2005. (*Chairman.*) They are all taken one with the other?—Yes.

2006. (*Mr. Harrison.*) What quantity of water do you use in dyeing that amount of plait?—2,000 gallons per day; I use a large quantity of water for it in the various processes, in rinsing and otherwise.

2007. (*Chairman.*) What quantity of that becomes liquid refuse passing into the drains?—There would be one-fourth lost at all events; you may say that 1,500 gallons pass into the drains.

2008. Which are contaminated with the dye refuse and the acids and the different ingredients?—Yes.

2009. Have you any difficulty in obtaining as much pure water as you require for your business?—None whatever.

2010. How do you get it?—Out of a well.

2011. By pumping it?—By pumping it.

2012. Do you pump it by hand labour, or by steam power?—By hand labour.

2013. Have you any idea of what it costs you a week to pump it?—I should say that 10*s.* a week would do the labour of it.

2014. If you could get as good a supply from the local board or from a company at anything like that cost, would you be a customer of theirs?—I do not think that I could get the large quantity I want in any other way so cheaply.

2015. (*Mr. Harrison.*) It would be 10*d.* for 1,000 gallons?—My men instead of standing idle pump the water, so that it costs me nothing except keeping the pumps in repair.

2016. (*Chairman.*) Have you any idea what proportion of dyeing you do, compared with the whole trade?—I do not know.

2017. Do you think that there is ten times as much as you do?—I think not; I do a great deal of it.

2018. (*Professor Way.*) Are you including the individuals who dye in their own houses?—Yes.

2019. Do you mean to say that there is not more than the labour of 120 to 150 people engaged in the dyeing and bleaching?—There may be more; I will not be sure, but I should not think that there is. Individuals do it at odd times.

2020. (*Chairman.*) Is there anything else which you wish to add?—No.

The witness withdrew.

LUTON.

Mr. Frederick Davis (Luton) examined.

Mr. F. Davis.

12 Dec. 1866.

2021. (*Mr. Harrison.*) You are a member of the local board of Luton?—Yes.

2022. Can you give us information as to the population of Luton?—I will give you the census in 1851.

2023. Can you give it to us in 1841?—I could if I had my books. I cannot give it from memory. I can remember the time when the population was 4,000.

2024. How long can you remember the town of Luton?—50 years.

2025. In what year was the population not more than 4,000?—In 1821 the population of the township was only 2,986, In 1841 it had increased to 5,827.

2026. You have written a history of Luton?—Yes.

2027. Can you put it in?—I can bring it down to you.

2028. What was the population of Luton in 1851?—I only speak of the township; 10,648.

2029. What was the population of the township of Luton in 1861?—15,329.

2030. Has the population increased rapidly since 1861?—I have taken the number of houses which have passed the board of health from the last census, up to last Christmas, and the average has been about 200 houses per annum, and the average inmates to each house at the time of the last census were between 5 and $5\frac{1}{2}$, so that taking the same basis of calculation of 200 houses the population has increased about 1,000 a year.

2031. What population would that give at the present time?—About 5,000 more.

2032. That would be upwards of 20,000 at the present time?—Yes; we consider that the population would now be about 20,000, but then we must take into consideration a place which has already been referred to, namely West Hyde, which has been complained of by the medical men; it has been called Brown Brick; it has grown up in the last three years, and there is a population there of 1,000, and although it is not properly in the township of Luton it still forms a part of Luton.

2033. (*Chairman.*) And it torments Luton by breeding disease?—Perhaps it does; but still it fairly, I think, belongs to the population of Luton.

2034. (*Mr. Harrison.*) What is this considerable increase in the number of people in Luton resulting from?—From importation a great deal.

2035. Is it to carry on manufactures in Luton?—Entirely.

2036. What manufactures?—The manufacture of straw hats and bonnets.

2037. (*Chairman.*) Then the births are not increasing at that rate?—No, we import young women from a distance, some marry and settle down, and some do not.

2038. (*Mr. Harrison.*) Is that rapid increase of population any index of the probable increase of pollution arising from the town of Luton?—I do not think that there is so much pollution in the town now as there was when there was the small population of 4,000.

2039. How do you account for that?—Entirely from the sanitary measures of the board of health.

2040. That is in the town itself, but I mean as affecting the river Lee?—I think that the river Lee must be clearer now than it once was, because all the sewage formerly ran into the river Lee, but we are now restrained by an injunction from the Court of Chancery causing or permitting that pollution.

2041. Is the increase of population an index of the increase in the quantity of sewage matter which reaches your sewage works?—I hardly understand that question; what has it connexion with?

2042. With the dyeworks and the other manufactories in the town.—If the main sewer is complete all the refuse runs down into the works, and it does not affect the wells at all, supposing that it does not escape from the sewers.

2043. All the people who are brought to Luton to carry on manufactures, and who are employed in dyeing and bleaching goops tend to increase the pollution of the matter passing from your sewer?—I think that the importation is more for the manufacture of the article.

2044. Rather than for the dyeing purposes?—Yes.

2045. (*Professor Way.*) A small power in the shape of dyeing and bleaching, I suppose, will suffice for a large quantity of water?—Yes, many families do all their own dyeing.

2046. (*Chairman.*) Have you anything further to add.?—I think not.

The witness withdrew.

Adjourned to Friday next at 10 o'clock, at Bishop Stortford.

Bishop Stortford, Friday, 14th December 1866.

Present:

ROBERT RAWLINSON, Esq., C.B., in the Chair.

John Thornhill Harrison, Esq. | Professor John Thomas Way.

BISHOP STORTFORD.

Mr. John Dobede Taylor (Bishop Stortford), examined.

Mr. J. D. Taylor.

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2047. (*Mr. Harrison.*) You are clerk to the board of guardians?—Yes.

2048. How many parishes are included in the union?—Twenty, containing a population of 20,000.

2049. Is the town of Bishop Stortford included in that union?—Yes.

2050. What is the population of Bishop Stortford?—A little over 5,000.

2051. Is it an increasing population?—No, not of late years. During the last 10 years it may have increased to the extent of 500 or 1,000; it was 4,000 and odd for some years, but it is not increasing now.

2052. What is the area of the union?—Over 19,000 acres.

2053. Does it lie chiefly in the valley of the Stort?—No.

2054. How far does the union extend?—The valley of the Stort runs to Sawbridgeworth, which is included within our union; it is four or five miles away.

2055. Are there any other places besides Sawbridgeworth included in the union?—There are 20 parishes altogether; the largest are Bishop Stortford and Sawbridgeworth and Stanstead in Essex.

2056. Is Stanstead within the valley of the Stort?—No; the Stort is an artificial canal beginning here, but there are some small streams which contribute to it and that run from Stanstead.

2057. What is the population of Sawbridgeworth?—Nearly 3,000; it is a very large parish and it is very much scattered.

2058. Besides the town of Bishop Stortford the population is chiefly agricultural, is it not?—Yes, the population of the union.

2059. Is there any other authority in the town of Bishop Stortford besides the board of guardians?—Yes, we have a highway board, and the inhabitants have recently resolved to adopt the Local Government Act, but that has not yet been put in force.

2060. Then any nuisance that may exist can only be remedied through the board of guardians at present?—Yes, through the board of guardians for the whole union, but as soon as the Local Government Act comes into operation the board will have authority to deal with nuisances in Bishop Stortford parish.

2061. The board of guardians cannot initiate anything in the way of improvements, they can only act in case there is a report made to them from some of the inhabitants that a nuisance exists?—Or through the inspector. They can only make structural works where a nuisance is not abated, not otherwise, and that is to a very small extent.

2062. Feeling the want of some authority to carry out improvements in the town, the inhabitants of Bishop Stortford have applied and are about to obtain power to adopt the Local Government Act?—Yes, I understand so.

2063. Do you know at all in what condition the public health is?—I think it has been pretty healthy as a whole—quite healthy.

2064. Is the town generally considered a healthy town?—I believe so.

2065. Do you know what the return of the registrar is as to the deaths per thousand?—I do not know that.

2066. Have there been any sewerage works carried out in the town?—No; except by the ordinary sewers draining into the river.

2067. Under whose direction were they constructed?—Lately they have been under the highway board; before their formation these matters were under the direction of the surveyor of the highways under an old Act of Parliament.

2068. Do the sewers discharge into the river?—Yes. The plan has been for many years for the parish to provide sewers for the houses as they were built, and into which the occupants of the houses might turn their filth, those sewers meeting each other in the town and discharging themselves eventually into the river.

2069. Are they carried out upon anything like a system?—I should say not. From time to time the surveyor of highways, and subsequently the highway board, have had a sewer made, and they have improved the sewers from time to time, and they have made others as they found that a greater quantity of filth required to be sent away. Thirty-five years ago there were not above two or three waterclosets in the town, but now they are to be numbered by hundreds.

2070. What manufacture is carried on in the town?—It is malt principally.

2071. Can you give any information as to the number of quarters of barley that are manufactured into malt in this neighbourhood?—No; but there are gentlemen here who will tell you that.

2072. Do you know of any nuisance that arises from the making of malt?—No, I do not think there is any particular nuisance except this, that the water from the cisterns in which the barley is steeped is turned into the river, and that helps to contribute to the pollution of it at certain times of the year, but as malt is made in the winter time the flood water carries everything away, and I should say that no great nuisance can be caused.

2073. Have you at any time observed that the liquor which is passed away after the process of steeping is objectionable?—I cannot say that I know much about that.

2074. What other manufactures are carried on besides that of malt?—None, that I know of.

2075. The town is an important town having a market, and providing for an extensive neighbourhood?—Yes.

2076. Business is carried on, I suppose, chiefly on market days?—Yes; a very large trade in the manufacture of malt is carried on.

2077. There is a canal leading to the town?—Yes, it is navigable to the town.

2078. A railway also passes through the town?—Yes.

2079. Is the traffic on the canal large?—I think it is.

2080. Is the valley at all subject to floods?—Very much so.

2081. What is the effect of those floods upon the health of the inhabitants?—I do not know. I have never had any complaints, nor has it been suggested that the public health has been affected by them. We are not flooded so much now as we were years ago. The millers do not hold up the water as much as they did.

2082. Does any person control them?—I think not.

2083. Do the waters sometimes lie for a considerable time upon the lands?—Yes, but they get away quicker than they did. If the rain continues they will be there for some days, but when the rain ceases they get away more quickly.

2084. Are they considered beneficial or injurious to the land?—They are not beneficial, I think, but it depends upon the time of year the flood comes upon the pastures. If the grass was to be mowed the flood would leave it all gritty and no animal would eat it; it would be useless to mow it; there is no doubt however that upon some pieces of land flooding would do good.

2085. Do you think it would be an advantage if there was some system of management throughout the valley of the Stort by which the water would be regulated, and better means provided for passing it off?—I should say so decidedly.

2086. Do you think that would be an universal advantage?—Yes.

2087. At the present time, as well as being a disadvantage to the meadows from the water hanging upon them, it backs against the water wheels and I presume actually injures the millers themselves?—I should say so.

2088. Any body who had power to improve the condition of the valley would not only improve it for agriculture but also for the benefit of the millers?—I should think so.

2089. How is the town supplied with water?—Principally by pumps.

2090. From what stratification does the water come?—It varies; we get the strongest springs on the hills; in some places they are 70 feet deep; all our hills are wet, and the valleys here are comparatively dry.

2091. What is the subsoil in the valley?—We get down to brick earth and loam—stiff loam; after that we get into chalk, and then find water.

2092. You are rather upon the clay?—Yes.

2093. And the chalk below is full of water?—Yes; we get gravel on some of the hills.

2094. As clerk to the board of guardians, have you had many complaints made as to nuisances existing within the union?—No; we have recently appointed inspectors for the union, and they have been at their work for three months past, since the Sanitary Act came into force, and they have removed an immense number of nuisances. Without requiring the board of guardians to interfere at all, the public have admitted the necessity of doing whatever they can, and they have met the thing uncommonly well. We found a very large number of cottage houses without any privy accommodation, and it is astonishing what a number in the last three months of new ones have been made, and others will be made. The board of guardians have not been obliged to put the provisions of the Act

BISHOP STORTFORD.

Mr. J. D. Taylor.

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in force against any one yet, the people have acceded most willingly; no doubt there are some cases which are now standing for consideration, but I believe that the efforts of the board of guardians and the local authorities will be effectually aided and willingly so by the inhabitants in carrying out the provisions of the Act.

2095. Before you appointed the inspectors of nuisances, did you find cases of sickness occur in certain parts of the town as distinguished from the health of the people in houses adjoining?—It has been recently so in one of the parishes of the union, where fever has prevailed to a considerable extent; in that case information was given to the board of guardians that it was caused by nuisances and bad drainage, and to some extent I believe the board considered that it was so. A great deal has been done in that neighbourhood, and the epidemic has ceased.

2096. Did that case occur in Bishop Stortford?—I think not. You may have some medical gentlemen here who will say that we have had fever arising to a great extent from defective drainage; it may be so, but generally speaking I believe that Bishop Stortford is a healthy town. We had some cases of low fever here some months ago, but it prevailed not only here but generally throughout the district, and it passed off after a time.

2097. (*Professor Way.*) The state of the public health is hardly observable by a non-medical person?—No, and I am not competent to speak upon the matter.

2098. (*Mr. Harrison.*) You are by profession a solicitor?—Yes.

2099. Have you heard of any advantage being gained from the lower price of coal by a railway being brought here?—There are gentlemen here who will give you better information than I can upon that.

2100. (*Professor Way.*) As I understand, you have applied to be placed under the Local Government Act?—Yes.

2101. In what stage is that application?—The clerk to the highway board, through whom the application was made, is here, and he will explain.

2102. It was not made through the board of guardians?—No.

2103. Do you know whether any legal proceedings have been taken as to the discharge of the sewage into the river Stort?—I never heard of any, and I believe there have been none. We have been threatened by several parties. Our neighbours at Sawbridgeworth have told us that we have been poisoning them. We have said that we are sorry for it, but we think that they contribute to the nuisance to some extent themselves, and we have therefore not heeded what they had to say.

2104. No actual proceedings have been taken against you?—Certainly not.

2105. (*Mr. Harrison.*) Has it ever been in contemplation to place the river under a distinct drainage board?—No. The nuisance of which the inhabitants have complained from the smell of the river was during the summers of 1864 and 1865, but it was very much abated in consequence of our having wet seasons, and a plan was adopted that succeeded remarkably well, and that was this: During the summer, when the water is very short, the filth will sometimes almost crop up to the mouth of the drains, and when there has been a flood in the winter this accumulation has been stirred up by a barge and a heavy rake behind, so that we have passed it on to our neighbour to some extent. We thought we had kept it long enough, and by the use of the flood water relieved ourselves from a considerable quantity of stink by that means.

2106. Do you think that there is a considerable amount of pollution in the river?—There must be, because we drain everything into it that we can.

2107. (*Professor Way.*) You say that the privy accommodation is being very considerably increased, do you mean that this accommodation is in the shape of waterclosets?—No, I am talking about cesspit accommodation.

2108. And that might indirectly affect the water if it does not directly do it?—It might; it would depend a good deal upon the position of the privies.

2109. If the town were placed under the Local Government Act could you then be required to take steps for the purpose of draining the whole of the town?—I really do not know.

2110. You have not contemplated that?—Yes, I have always contemplated that if we were put under the Local Government Act considerable works would have to be carried out to get rid of the sewage in a different way. I have foreseen that there would be very considerable outlay required, and I do not know that the town would be indisposed to make the outlay if they could see a means of effectually doing the work. The difficulty that I have always seen in the matter has been this,—that we may probably spend a considerable sum of money in carrying out some well-organized plan, and perhaps, very shortly afterwards, some general measure may be passed in the House of Commons affecting the whole country, and all we had done might be rendered useless. I believe that the inhabitants of the town and all the ratepayers have looked at it in that way.

2111. You have spoken of getting rid of the sewage; there are two stages in doing that, and the first is to get rid of it by passing it into the river?—We do that now.

2112. Not all of it, because the town is not fully sewered?—No.

2113. I suppose the more perfectly the town is sewered, if no arrangement is made to dispose of the sewage other than by passing it into the river, the greater will be the nuisance?—Yes.

2114. At first, probably, the town is contemplating, by putting itself under the Local Government Act, steps that will tend very largely to increase the impurity of the river?—I have no doubt that that has been passing in the minds of many gentlemen who have taken the subject up.

2115. (*Mr. Harrison.*) As a solicitor practising in the town, you probably know something of the ownership of the land in the neighbourhood?—Yes.

2116. Do you think there would be any difficulty in obtaining land below the town to which to apply the sewage of the town?—I have heard that there will not be any. An opinion, I know, was entertained that there would be no difficulty; probably there would be some difficulty which might be overcome. The difficulty we have always seen has been as to the meadows. They lie here very low, and they are all subject to floods frequently.

2117. Is there a considerable flow in the river?—No.

2118. What is the value of the land in the neighbourhood?—It is very valuable.

2119. Beyond a mile from the town?—It would fetch 100*l.* an acre. I speak of purely agricultural land. There is accommodation land close against the town, but that is getting very high too. Common agricultural land within a mile of the town is worth 100*l.* an acre.

2120. There are about 6,000 inhabitants?—Yes.

2121. Then you would not require more than about 40 acres of land to which to apply the sewage?—Perhaps that may be so.

2122. (*Professor Way.*) Bishop Stortford is about 32 miles from London, I think?—Yes.

2123. Is milk ever sent to London from this neighbourhood?—I think not.

2124. Is there any further information that you wish to give us?—I think not.

The witness withdrew.

Mr. Henry Glasscock (Bishop Stortford), examined.

2125. (*Mr. Harrison.*) Are you surveyor to the highway board?—Yes.

2126. How long has the highway board been formed?—I have been surveyor about seven years.

2127. It is not a highway board formed under a recent Act?—No, it is not under that Act.

2128. What is the extent of the district over which you act?—There are about 11 miles of road.

2129. Does the district include any parish besides that of Bishop Stortford?—No.

2130. Does it include the roads through the town?—The turnpike road is part of the road that is connected with the town. I have about 11 miles of road as surveyor of the highway board to look after.

2131. Has the Highway Act been carried out in Hertfordshire to any extent?—No, but in Essex it has been—at Dunmow.

2132. What are your duties as surveyor of highways?—I am inspector of nuisances and I give attention to the state of the roads.

2133. Do the sewers of the town come under your management?—Yes.

2134. How far has sewerage been carried out in Bishop Stortford?—Pretty well through the whole district where there is any house property; not exactly to the whole of it, because some of the houses are at some considerable distance from the town, and there we have not sewered, but nearly the whole of it is sewered.

2135. Is the town sewered upon any system?—It has been going on for a number of years, but not upon any scientific principle.

2136. How many outlets are there?—Seven.

2137. Where are they situated?—We commence with two in Lee Street, then we come to the end of the town and the river, there is a main sewer that empties itself there, then we have four others in South Street.

2138. Where do they discharge themselves?—Into the river.

2139. What is the size of the main sewer?—The largest is 18 inches.

2140. Of what shape is it?—It is a barrel drain.

2141. Are the houses connected generally with those sewers?—No, I should think that about 300 of them are connected with the sewers from waterclosets and there are about 400 cesspools in the parish.

2142. How are the waterclosets supplied with water?—By private individuals for their own use.

2143. Do they pump the water up?—Yes, it is all done by pumps.

2144. Have you occasion to open up those sewers in different parts of the town from time to time?—Yes.

2145. In what state do you find them?—Some part of the town lies very flat.

2146. What do you find the state of the sewers is there?—Generally there is an accumulation of grit more than soil, which gets washed in from the washings of the roads.

2147. You find them so filled?—Yes, at times.

2148. What steps do you take to clean them out?—We thoroughly clean them out when we find them in that state.

2149. Have you to open a considerable length of drain in order to clean it out?—Yes.

2150. What length of drain have you had to open out and clean upon any occasion?—From 100 to 200 feet at different places.

2151. Are they constructed generally below the surface?—Yes.

2152. At what depth are they below the surface?—They are not very deep, on account of the fall to the river. A large portion of the town lies exceedingly flat, and of course we cannot get our sewerage down very deep on account of the river.

2153. Is there any ventilation to those sewers?—No; they are principally trapped.

2154. Have any complaints been made to you at any time of the gases being driven back into the houses and causing a nuisance?—Yes; I have had complaints made.

2155. Do they continue to be made?—I should say that the cause of that is on account of our sewers being so trapped, and that private parties when they leave a house often leave their drains not trapped, and there an escape of gas takes place.

2156. You trap it in the sewers under your control, and by that means you force it up the side drains into the houses, and where they are not trapped the gases find their way into the houses?—Decidedly.

2157. Have you on any occasion known sickness to arise in a house in consequence of the gases flowing back into them?—I cannot say that I ever did; but parties have sent for me frequently, and I have found that that was the cause, and in such cases the thing has been remedied.

2158. If there was a proper system of sewerage in this town, there ought to be no occasion to open the drains in the way you have just mentioned, 100 or 200 feet at a time, and there should be no gases passing back into any house causing a nuisance?—Such is the case, no doubt.

2159. How many cesspools are there in the town?—I think there are 400.

2160. And 300 water closets?—Yes.

2161. What is the character of the cesspools?—They are made of brick dug out of the earth, and closed in.

2162. What is the soil generally in which they are made?—It principally consists of brick earth here and strong clay.

2163. Impervious clay?—Yes.

2164. Is there any percolation?—No. We should not consider so at all.

2165. What steps are taken, or do you take any, to remove the refuse collected in those places?—We have done a great deal in that way during the last few months. By order of the highway board we were directed to go from house to house and to clear out everything.

2166. At whose expense was that to be done?—Partly at the expense of the highway board, and from them at the expense of the board of guardians.

2167. Not at all at the expense of the individuals?—Not at all.

2168. What expense may you have incurred in the last eight or ten months in removing these nuisances?—I cannot state exactly, but I should think 25*l.* or 30*l.*

2169. Were the directions which your board gave you to cleanse these places out systematically?—Yes, and we have done so.

2170. Shall you continue to do so?—I have not received any further orders.

2171. Was it merely a temporary effort in consequence of the cholera being in the neighbourhood?—Yes, that was the cause of it being done.

2172. Do you not think that some measure more efficient than that is required in order to prevent nuisances continually arising?—There is no question about it, and if it is not done in that way accumulations will grow up again.

2173. (*Professor Way.*) Do you remember how many years ago it is since it was first done, or has it been done before in your recollection?—It has only been done once during my term of office in seven years.

2174. What are the sizes of the cesspools generally?—They are between three and four feet square.

2175. Does one serve for one house, or more than one house?—There is generally one for two houses and sometimes for three.

2176. I suppose the water from a house drains into the drain of the town?—Yes, principally so.

2177. Nothing goes in there in the shape of water?—No.

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2178. Do you believe that ashes are thrown in?—Yes, at the side of it, but not into the cesspool generally speaking.

2179. Are these cesspools made with clay bottoms and clay sides, and then lined with brick?—Yes, they are principally so made.

2180. Will more than two families join in the use of these cesspools?—No, not generally speaking.

2181. Two families consisting of from 10 to 12 individuals?—Quite that.

2182. As I understand you, it would take seven years to fill one of them?—They are obliged to be emptied about every second year. I was not speaking of the cesspools when I said it would take seven years. It was the ashpits that I meant. We were ordered to go and cleanse every yard. Not all the cesspools, but many, were cleansed out. I do not think that the parish had been so clean before for many years as it was at that time.

2183. Have the cesspools any overflows?—No, only into the sewers; there are some connected with the sewers.

2184. With overflows at the top of them?—Yes.

2185. You draw a distinction between cesspits and ashpits?—Yes.

2186. Will you describe the cesspools as distinguished from the ashpits?—Generally speaking the ashpits are made purposely low down in some portion of a garden—at the bottom of it. The cesspools are about from three to four feet sqaare, and of various sizes.

2187. Of what depth are they?—They are three or four feet deep.

2188. How many ashpits do you think there are?—There is one to every house; that is, not an ashpit, but there is an accumulation at every house.

2189. How do the inhabitants obtain their water?—I think as to water we are well supplied.

2190. What is the source of your supply?—We get the water from wells.

2191. Are those wells sunk through the clay that you mentioned just now?—Yes, and they get into the chalk.

2192. Throughout the township is there an abundant supply of water?—Yes, there is.

2193. Are there any gravel beds in the town overlying the clay?—Yes, just under the clay.

2194. Is water drawn from that bed in any case?—No, it is principally from the chalk.

2195. It is almost always carried through the gravel to the clays and the chalk, is it?—Yes.

2196. Is it very hard water?—I have heard it so spoken of, at least some part of it.

2197. Do the gravel beds run under the "George Hotel"?—Yes.

2198. Do you think that they get water from the gravel?—It is supposed to be one of the finest springs we have in the country. I have been speaking of the water with reference to the general health of the town.

2199. Would there be any difficulty in applying the sewage to the land below the town for irrigation?—That has been thought of, but I think there would be a difficulty in it.

2200. What would the difficulty be?—On account of everything lying so low.

2201. You could pump it?—Yes.

2202. If you were obliged to pump it, would there be any difficulty in obtaining land?—I believe some offers have been made of that description.

2203. What is the condition of the river as it passes through the town in consequence of the sewage being delivered into it?—We do hear complaints about it.

2204. From whom?—I have heard complaints from Sawbridgeworth, from people living there by the river.

2205. Have any complaints been made by residents in the town of Stortford?—Not particularly, that I am aware of; Mr. Davis has complained to me about it.

2206. Does he reside near the outfall of one of these sewers?—Not exactly; he is between two of them.

2207. How far are they apart?—I think they are from 200 to 300 yards apart.

2208. He is situated between the two, and not near either of them?—Yes.

2209. Which of them is he nearest to, the upper one or the lower one?—The upper one.

2210. When complaints of this kind are made to you, do you report them to the board?—They have been made to the board.

2211. Are they entered in a book when they are so made?—Minutes are always kept by the board.

2212. (*Mr. Harrison.*) They would appear in their books?—Yes.

2213. During the summer season is there much water coming down the Stort?—No.

2214. What becomes of the refuse from the sewers when there is so little water in the river?—It must of course accumulate.

2215. It would accumulate in the bed of the river, would it not?—Decidedly.

2216. And become a nuisance, and as you say, it would be complained of by some people?—Yes.

2217. As surveyor do you take any steps to remove the nuisance?—In the case of a flood we stir it up, if we have an overflow of water.

2218. And send it on by the flood to your neighbours below?—Yes, we get rid of it.

2219. Are you aware that the water, after it goes from here goes to London, and is one of the sources of the water supply?—Yes.

2220. Do think that that should be permitted to continue?—I have no doubt that some steps will be taken to remedy that sort of thing.

2221. (*Professor Way.*) When you stir it up, I suppose it is about at its worst?—That is the only means we have of disposing of it; when we get a flood we get rid of a large amount of it.

2222. Do you fancy that discharging the sewage occasionally in a flood, or discharging it regularly day by day so as to be able to distribute it equally, would cause the greater nuisance?—We cannot get rid of it except at the time of a flood.

2223. But the form in which you get rid of it probably constitutes the greatest nuisance you could create?—Yes.

2224. (*Mr. Harrison.*) Have you, as surveyor, to collect rates to meet the expenses of the highways?—I had to collect rates until within the last six or eight months.

2225. What is the rateable value of the parish?—I think that the last estimate was 23,700*l.*

2226. What is the annual rate in the pound collected for the maintenance of highways and for your superintendence?—It has been 8*d.*, this year it will be 1*s.*

2227. (*Professor Way.*) Do you know how many of these cesspools have overflows?—About 300. I mean the refuse of the waterclosets that flow into our sewers.

2228. I think you stated that the cesspools have an overflow at the top?—Yes; some of them have. I am speaking of those; I included those in the water closets.

2229. The waterclosets have cesspools, but with overflows?—Yes.

2230. Then the refuse in them does not go direct from the waterclosets into the drains?—Not all of them. I consider that there are 300 which are connected directly with the sewers.

2231. Have they any cesspools?—No; certainly not. I mean that there are 300 waterclosets that drain into our sewers, that go into the river.

2232. How many waterclosets are there, as we understand them generally, the contents of which go direct into the sewers?—I cannot say off hand.

2233. Do you think that the majority of them have cesspools as well as drain into the sewers?—Yes.

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2234. It is only the liquid that drains into the sewers?—Yes.

2235. In London the houses have direct connexion, by means of a pipe running into the main drain, without any cesspool at all?—Yes.

2236. On the other hand, we know that there are such things as cesspools in the country districts with overflows into drains. What is the general character of the waterclosets here?—Some 10 years ago, when there was an order given with reference to the sewerage of the town, many of the waterclosets were connected with the drainage direct, that I am now speaking of, still they had no water supply further than that which they drew for themselves. They had no pumps.

2237. Have those got cesspools?—No; the cesspools were done away with at the time that these places were connected with the sewerage.

2238. How many do you suppose there are connected directly with the sewers but without cesspools?—I should say 300. We were ordered some years ago to take the sewage direct from the waterclosets into our sewers, and they were then connected with the sewerage.

2239. The figures I have taken down are the 400 cesspools and 300 waterclosets. Do you mean to say that those are all waterclosets, but that 400 are waterclosets with cesspools, and the 300 are waterclosets communicating directly with the sewers without cesspools?—Yes; as near as I can give it.

2240. (*Mr. Harrison.*) How many privies are there in the town?—I think there are 400.

2241. I believe the highway board consists of the whole of the ratepayers in the parish?—Yes; they are selected from the parish.

2242. For how long are they appointed?—They are appointed every year.

2243. Of how many do they consist?—Thirteen.

2244. Is there any other officer besides yourself?—Yes; there is a clerk.

2245. Are there men employed under you?—Yes.

2246. How many are there employed?—The number varies from five to seven, according to the nature of the work.

2247. Are they employed in repairing the roads and opening and constructing drain?—Yes; when they are required. My own men do not construct drains.

2248. Not the main drains?—Not the men under my control. They do not do anything of that sort; the work is put out to tender, and it is done by the parish.

The witness withdrew.

Mr. R. Hunt.

Mr. Richard Hunt (Bishop Stortford), examined.

2249. (*Mr. Harrison.*) Are you resident in Bishop Stortford?—No, but I come here occasionally.

2250. Are you a native of the town?—No, but I have known it from childhood.

2251. Do you own any property in the town?—Yes.

2252. What is it?—South Mill.

2253. How long have you owned it?—About nine or ten years.

2254. Have you resided there at any time?—No, but I go there two or three times a week sometimes.

2255. Is that mill near to any of the sewers that the surveyor has spoken of?—It is just below them all, I think, about a mile from here.

2256. Is there any nuisance arising from the sewage of the town being passed into the Stort?—Very great just now, and there has been in the last two or three years.

2257. How does it affect you at the mill?—The stench in the mill and dwelling-house and the neighbouring yard and garden is very bad in the autumn and summer of the year, so bad that in 1865 the miller who lived in the mill-house complained that he was obliged to send his wife and children away.

2258. Is there no one living there now?—Yes, but he sent them away in the dry time.

2259. Was their health affected by it?—Yes, very much.

2260. Had they to call any medical man in consequence?—Yes.

2261. Did he attribute their sickness to the condition of the river?—Yes; and he complained himself when he went into the house, so much so, that I consulted my solicitor about it, and I talked to Mr. Taylor and threatened proceedings against the town, but I hardly know whom to begin with.

2262. Is there much difference in the volume of water that comes down the Stort in the summer season and in the winter season?—Yes, very great.

2263. In the summer season is it reduced to a very small quantity?—Yes, very small.

2264. How many pairs of stones have you at your mill?—Two.

2265. Can you drive both of those pairs of stones in the summer time?—Not one, nor half a one. It would be I should think for about 10 hours out of the 24 with one pair of stones in the summer time.

2266. The sewage of Stortford being thrown into this small volume of water passing down to your mill increases the nuisance very greatly?—Yes, in the autumn part of the year; there is but little to complain of now on account of the large volume of water in the river.

2267. That has probably cleared away all the nuisance?—Yes.

2268. What regulations are there as to adjusting the quantity of water taken for your mill and for the canal?—The canal company have a right to take as much water as they require for passing and repassing barges, and they pay to the millers sixpence each time they fill their lock.

2269. Do you know what the size of a lock is?—Not exactly; but I think it is about 100 feet by 14 and about five feet deep.

2270. What fall have you at your mill?—About five feet or rather more—five or six feet.

2271. During the winter, when you say there is a large quantity of water passing down, do you find that your mill wheel is obstructed by tail water?—In a heavy flood, but not all the winter, for there are overflows or tumbling bays above each mill, above which the miller may not keep his water, it runs away and it does not affect us more than two or three inches when the section of the river is not so large, then it does for two hours.

2272. Is that often the case in the winter?—Yes; sometimes we have gone through a winter without a flood, and sometimes we have six or ten down in the same time.

2273. For what length of time do they obstruct your work?—It is variable; perhaps two or three hours; I mean not more than that unless we have two heavy falls of rain continuously, and that is very seldom.

2274. Have you any land adjoining the mill?—Yes, I have two acres.

2275. Are they liable to be flooded?—No, not unless it is a very high flood. I believe they have been flooded once or twice.

2276. Is the land that is flooded benefited, or otherwise, by it?—The land which adjoins the mill will be benefited by the flood—the small piece that belongs to me.

2277. Would the remainder of the land nearer the river and lying at a lower level be benefited in a similar manner?—Not unless there was a good drainage to it to get it off quickly.

2278. Is there good and sufficient drainage to the land in the valley of the Stort?—I am not able to answer that question. I have a very good knowledge

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of my own land; but I think there is generally good drainage in the valley of the Stort.

2279. In coming up by the railway last night I observed a great deal of land which appeared to me to be in a very indifferent condition?—Yes; lower down there is a large piece of land called the Mead, of 160 acres, and that is very frequently under water; it will be now drained and inclosed.

2280. Is that to be done under a special Act of Parliament?—Not for the parish, only under the General Inclosure Act.

2281. Not under the powers of a new Act?—No; besides the inclosure they will carry the outfall below another lock in order to get more fall.

2282. Does that merely extend to a short length of the river?—Yes, about a mile and a half or two miles.

2283. Do you not think it would be much better to have the river put under some general management, and carry out arterial drainage efficiently throughout the whole length of it?—I have not sufficiently thought of that to be able to give an answer to the question.

2284. Is what you have mentioned being done with the consent of the millers below?—There is no mill, as it happens, at this lock.

2285. Is there a weir without a mill?—Yes, a waste weir, and that is near the junction of the Stort with the Lee.

2286. As an owner of mill property, if there was a good system of drainage carried out throughout the valley, and if the flood waters were carried off more uniformly than they are now, would you not be benefited rather than otherwise by such a measure?—Yes, in some cases. I have a mill nearer to London, and and we suffer very much from flood water there.

2287. Is that upon the river Lee?—Yes, it is the last mill but one on the Lee, at Edmonton.

2288. Do you suffer at all from back water?—Yes, we suffer from back water and from the water getting out on to the meadows and lying there for days together.

2289. Do you live near to that place?—No, I live near to the junction of the Lee and the Stort.

2290. Are you near to the valley that is liable to be flooded?—Yes.

2291. Do you know whether the flooding of that district affects the health of the people living there?—I have heard that it does not; they say that a case of ague is rarely known in the valley of the Lee.

2292. Have you ever known of any cases of ague?—Very rarely; only one or two.

2293. Have you known fever to occur after the valley has been flooded for a considerable time?—No, I have not, the valley is so thinly populated.

2294. Is there any arrangement as to the payment by the Canal Company generally throughout the valley of the Stort?—The whole way down. I think it applies generally to every mill but one, and there are 11 or 12.

2295. What is the exception in that case?—I do not know.

2296. For each lock of water a payment is made of 6*d.*?—Yes.

2297. Is that so in the case of each lock?—Yes, it is paid to the miller adjoining. The barge owner generally pays 1*s.* when he goes through, and he comes back for the same payment.

2298. Does that repay the miller for the use of the water?—No, certainly not.

2299. If you had the water to use which they take, I suppose you would be able to turn over something more than 6*d.* by its use?—Yes, three times the money.

2300. (*Professor Way.*) Do the bargemen open the locks?—In some cases the owners of the canal keep a lock man to work two or three locks.

2301. The miller does not do it?—No. As to the injurious effect to health by the drainage being passed into the river, I may say that it was not so a few years ago. When I was a boy there were plenty of gudgeon and small fish in the river, but now one cannot live in it. A friend of mine lives 10 miles lower down, and he will tell you that he can remember when there were fish in it there.

2302. What is the condition of the water that comes down to your lower mill at Edmonton?—There it is apparently clear, but this water goes there and the water from Hertford too.

2303. Then they will have at Edmonton a larger volume?—Yes. I have a mill also at Stanstead, and there the water is offensive at times from the drainage of Hertford.

2304. Notwithstanding the steps which are taken at Hertford to purify it?—Yes; I have passed along the towing paths and I have had to put my handkerchief to my nose on account of the stench; that has been in the autumn of the year.

2305. Is the sewage of Ware turned into the river?—Yes; nothing is done with the sewage there, it comes in neat, but the sewage of Hertford is deodorized. The New River Company has a fixed volume of water from the river Lee above the point where the sewage of Hertford comes in, and they take in the autumn, when the water is short, nearly their full quantity, and we have scarcely any water in the Lee then.

2306. How are you paid, as a miller, for the water that is taken out there?—The millers receive no payment; it was done first by agreement some 150 years ago with the river Lee trustees, but since then there has been another agreement made, in 1851, by which they were to take a further quantity of water, and the millers were deceived.

2307. How many pairs of stones do you drive at the mill below Ware?—I had 10 when I first took it some 25 years ago, but the water has got considerably less, and we have but six now at work.

2308. Can you work them constantly in summer and winter?—No; nor can we work two in some summers. As I have said before, in a dry summer the quantity of water that is taken by the New River Company is always the same, and it takes all the water almost away; we have not water then for more than one or two pairs of stones.

2309. Is the water that is taken by the navigation larger than it was formerly?—I do not think it is; I think it is rather less at Stanstead weir.

2310. The diminution which you experience arises from the New River Company taking a larger volume?—Yes; there is certainly less water in the valley than there was 20 or 30 years ago.

2311. How do you account for that?—In this way, a great deal of woodland has been destroyed and there is less rainfall.

2312. Have you observed the rainfall over a series of years?—I have been informed that where the gauges have been kept they have found it so; they have been kept by the New River Company.

2313. Do you know how long they have been kept?—I believe for some years. I should mention that they have been sinking a number of deep wells at the lower end of the valley.

2314. Does that affect the discharge of the water in the upper parts of the valley?—Yes.

2315. The water which they abstract must come from somewhere?—Yes, it comes down through subterranean channels, but we cannot get the water we used to have. Who has got our water? We know that we have lost it; and the old millers will tell you that there is not now nearly the quantity of water there was 30 years ago.

2316. After making allowance for the increased quantity of water the New River Company take, you find that there is less?—Yes; and that applies to this stream particularly. We have no control or power at all, and there were two mills that I knew, which in the course of 20 years have been done away with because there was not a sufficient quantity of water to make it worth anyone's while to occupy them. On another branch of the Lee, the Rib, the river is entirely dry, there is no water for a mill.

2317. Do you know of any other cases where mills have been abandoned from a similar cause?—Not that I can speak to.

2318. How many years have you occupied the mill below Ware?—25 years.

2319. In that period have you experienced a marked diminution in the volume of the water?—Yes; I have a mill also, and my family have two, on the Ash, which is another feeder of the Lee, and there again the water has disappeared in my time. More than one half the upper portion of the Ash is dry now.

2120. That I suppose would not be affected by any obstruction of water by the New River Company?—Not at all.

2321. You attribute the falling off of the water to two causes, the clearing of woodland in the neighbourhood and the consequent diminution in the rainfall and the abstraction of water by extensive pumping establishments?—Yes, by brewers and manufacturers, and there are many other causes that might be mentioned; for instance, farmers have taken to deep drain their heavy spongy land which retained the water very much, mixed varieties of soil containing gravel which would hold the water and supply us in the summer; through these lands they have driven five feet drains and these cause a flood in the winter, but the water is short in the summer; that is another cause. But I think the principal cause is the deep wells which have been sunk near London called artesian wells,

2322. (*Professor Way.*) Are there any deep wells in this district?—Yes, the New River Company have two or three wells.

2323. Do you think their level is interfered with by the pumping which takes place in London; we have heard that in London at the great breweries they do not pump on Sunday?—The wells I have referred to are comparatively new wells within the last 15 years, and I know they are affected. They sunk a well 15 or 16 years ago at Amwell and that is almost dry; they are spending money now to get lower down.

2324. Have you heard that the wells at Watford and some other places in the neighbourhood of London, in the chalk, are deepest on a Monday morning, and that they have several feet more water then?—No, I have not heard of that.

2325. Because the brewers have not been pumping on Sunday?—That may be so. In the autumn of the year the brewers do work very much, and the New River Company, in the largest wells about here, pump all Sunday.

2326. (*Mr. Harrison.*) Do you know whether at your mill below Bishop Stortford any of the nuisance you have mentioned arises from refuse poured in by maltsters?—Some little of it may, but I do not think it will affect us. We did not complain before the sewage of the town was turned in.

2327. Was malting carried on to as great an extent then as it is now?—Not quite to so great an extent, but the water that comes down from the cisterns is not always bad and is not at all offensive if the barley is clean; sometimes it is worse.

2328. Generally speaking, I believe it is delivered in the autumn and winter when there is an abundance of water in the river?—Yes, in the winter and spring.

2329. Have the millers below you experienced a similar kind of falling off in the quantity of the water near Edmonton?—Yes, they find that it is very much less.

2330. How many pairs of stones do you drive there?—Fourteen.

2331. Are you enabled to work them all in the summer?—No.

2332. How many are you able to work?—The number varies; sometimes I work them all for two or three years together, sometimes I work six or seven pairs, and sometimes only five. I know a mill where I was engaged when I was a boy, and there were there but six pairs of stones with bad machinery, and I never knew a year that they did not have as much water run to waste as they used. We work about five or six pairs of stones now from shortness of water.

2333. Would that diminution in the volume of the water, do you think, be accounted for by the increased abstraction of water by the New River Company and the East London Water Works Company?—Not by the East London Water Company, because they take water below us.

2334. Would it then be accounted for by the increased quantity taken by the New River Company?—Yes, I think so, and by the other causes I have mentioned.

2335. Have you much nuisance to complain of at that mill near Edmonton?—No.

2336. Do they suffer from the flooding of the water below you?—No; my partner lives on the bank of the river, and he has a large family, and they are remarkably healthy.

2337. (*Professor Way.*) You have attributed to two principal causes the falling off of the waters of the Stort of late years, viz., the diminished rainfalls and the wells; I suppose that one of those may be a substantial and obvious cause—the wells?—Yes.

2338. Might they not account for the greater part of the diminution, if not the whole, without taking into account the smaller rainfall?—I have been speaking of rain gauges kept in London, not here.

2339. It may be a fact, and probably is, that the cutting down of trees generally has diminished the amount of the rainfall?—The underground and the wood was a great reservoir of water in the summer time. It held the water up much longer.

2340. Your statement that there is less rainfall might be controverted, but it does not follow that you are in error in saying there is less water in the valley?—I know that as a fact.

2341. (*Mr. Harrison.*) Has that diminution been marked within a short period?—No; it has been going on as long as I can remember.

2342. The water has been gradually diminishing since you can remember?—Yes. I can mention half a dozen places where feeders of the rivers Lee and Stort had mills upon them, but in which there is now no water at all.

2343. Will you just mention them?—Bendfield, Elsenham, Haddam, and Waltham Abbey are instances.

2344. The cases you have mentioned are cases of mills which you know were in existence some years ago, and which, in consequence of the diminution in the water, if not its total abstraction at certain points, have ceased to exist?—Yes; they have been given up.

2345. Is there anything more you wish to mention?—No.

The witness withdrew.

Mr. JOHN D. FAIRMAN (Bishop Stortford), examined.

2346. (*Mr. Harrison.*) Are you a resident here?—Yes.

2347. Do you carry on business here?—Yes; I am a maltster.

2348. Have you been engaged in that business for many years past?—I have been in business for 14 years. I have lived here for about 18 years, and my father before me.

2349. Can you give us any information as to the number of quarters of barley that are converted into malt at Bishop Stortford in a year?—I can tell you what I do at Bishop Stortford, and that is about 40,000 quarters.

2350. Is that a large proportion of what is malted here?—It is a large proportion.

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2351. What proportion does it bear to the whole?—I cannot tell you.

2352. How many maltsters are there in Bishop Stortford?—Seven or eight.

2353. What becomes of the water which you use for steeping the barley?—From my maltings it nearly all goes into the river.

2354. Is it objectionable in its character?—I do not think I have ever had any complaint made about it. I have not found it any nuisance, and I have often been in the habit of going round the maltings when the water has been let off. I may say that I have not had two complaints made since I have been in business.

2355. Have you noticed in other cases that the water so discharged has been a nuisance?—No.

2356. Some of the malthouses lie up the hill, do they not?—Yes; I have several that are up the hill.

2357. Where does the water pass to from them?—I suppose it goes into the main sewer, and thence into the river.

2358. Is the barley that you malt here chiefly grown in this neighbourhood?—No.

2359. Where does it come from?—From Norfolk, and Cambridge, and Essex.

2360. Has the malting trade of Bishop Stortford increased of late years?—I should say that it has increased very much.

2361. How would you account for that increase of trade?—I may observe that the railway has benefited me, because if the supply of barley here is bad I can get it from an equal distance with other people, and that puts me on equal terms with the rest of the world. My business is certainly two thirds, and more than that, larger than it was before the railway was brought here.

2362. You have derived a benefit from the railway passing through this district?—Certainly I have.

2363. Is the canal used for the carriage of barley and malt to any great extent now?—I cannot tell you. I only do business with the railway company.

2364. You receive your barley by railway and you send it off, converted into malt, by railway?—Yes, that is so.

2365. How do you get your coals?—I get coals both by the railway and the navigation. The one is a very wholesome check upon the other.

2366. Do you live in the town?—Yes; on the top of the hill.

2367. Have you observed the condition of the river from time to time?—Yes.

2368. What is your opinion as to its condition in consequence of the sewage of Stortford being passed into it?—I have known it to be in a very bad state.

2369. At what period of the year?—In the summer.

2370. In dry seasons?—Yes; and we have had several complaints made about it to the highway board. I am a member of it, and that is why I suggested to our surveyor that we had had several complaints from persons living close to the river; for instance, Mr. Taylor has represented that the stench has been so great that Mrs. Taylor could not sit in her drawing room in the evening, such was the state of the water; but we got rid of it entirely by means of a barge with a large rake behind stirring it up and passing it on.

2371. As a highway board, I believe you have applied to be placed under the Local Government Act?—Yes.

2372. Do you propose to carry out a system of sewerage in this town?—I have voted for it and for this reason, I thought that something would be done which would benefit the town.

2373. Are you aware that the sewage of many towns is now very successfully, and with advantage to the towns, applied to the land in the neighbourhood?—Yes; we thought of that. The highway board have all come to the determination that something will have to be done, and the question was, what was the best thing to be done.

2374. Do you propose to carry out a system of sewers?—I do not think we have any plan.

2375. Do you propose to have any water supply urther than you have at present?—I cannot tell you, but we shall get the best opinion we can.

2376. Where do you obtain your water for malting?—From wells.

2377. Is that water very hard?—I consider that the water is very hard. It is very hard in my own house.

2378. Is it suitable for malting purposes?—We consider that we make pretty good malt here, and I suppose the water must be good.

2379. As a maltster, should you consider that hard water or soft water was better for brewing?—I think I should prefer soft water if I was asked.

2380. What is the effect of the application of water, is it to encourage the growth of the barley?—Yes; and the quicker it grows the better.

2381. Do you think that soft water would produce that effect?—Yes, I fancy so.

2382. (*Professor Way.*) There is no particular secret, I suppose, in the making of malt?—Not any that I know of.

2383. The barley is first soaked in water?—The barley is first steeped in water.

2384. In a large quantity of water or only enough to cover it?—Just enough to cover it.

2385. How long does it remain so?—Sometimes 48 hours and sometimes 64 hours, but it depends upon the barley.

2386. It remains until it is soaked?—Yes; it depends upon the season.

2387. Do different kinds of barley produce different coloured waters?—Yes; I should say that barley from heavy land gives water a much higher colour than barley from light land.

2388. Heavy land is not so good as light land for growing barley, is it?—I prefer barley that is grown in light land.

2389. Not only because it malts better, but I suppose it is better for the brewer?—I suppose that they get a greater amount of extract from it.

2390. You pay more money for barley grown in light land, do you not?—No; that depends upon a man's opinion.

2391. Does not a farmer get more profit out of light land than out of heavy land?—That I cannot tell you.

2392. (*Mr. Harrison.*) Have you ever known a case in which, after converting barley into malt, the barley has increased to such an extent in bulk that the exciseman was inclined to disbelieve the fact and to fine you?—I do not believe that barley, if the trader is an honest man, will increase to such an extent as to give any exciseman good grounds for suspecting anything. I think, generally speaking, there is nothing in the ground in which the barley is grown.

2393. (*Professor Way.*) What is the colour of the water that you run off after the barley has been steeped in it for 48 hours?—Of a deeper colour than the wood work there.

2394. Is it thick?—No, I think it is not thick sometimes.

2395. Will it settle if put into a vessel?—Yes.

2396. Something falls to the bottom?—Yes.

2397. What is that?—I cannot tell you.

2398. Is part of it dirt?—Yes.

2399. And the liquid will still remain of that colour?—Yes.

2400. Do you know whether that water has ever been applied in any way to grass or any other culture?—I have not heard of it.

2401. Do you think it would be possible to use it and to pump it over grass land?—Yes, it might empty itself into a tank if it was anywhere where it could be so used.

2402. Supposing it not to be so used, the water must pollute the river?—I suppose you will compel us to take it away.

2403. Could you pump it over any ground?—No,

you must carry it away. The maltings are all in the town, and you could not pump it on to the land.

2404. I suppose when you speak of soft water you would get more colour out of the barley with that?—No, I do not fancy so; we very often change our water in 24 hours.

2405. (*Mr. Harrison.*) What volume of water do you use to a certain number of quarters of barley?—We first fill the cistern with barley, and we keep pumping in the water until the barley is covered.

2406. You do not use a very large volume of water?—No, certainly not.

2407. Of what size are your tanks?—The cisterns are of different sizes, according to the malting.

2408. (*Professor Way.*) Do you pump by hand?—Yes.

2409. You cannot tell how much water you use?—Not in the least.

The witness withdrew.

Mr. Thomas N. Miller (Bishop Stortford), examined.

Mr. T. N. Miller.

2410. (*Mr. Harrison.*) Are you also a maltster?—Yes.

2411. What number of quarters of barley do you malt in a year?—From about 10,000 to 12,000.

2412. What is the size of the tanks in which you steep the barley?—They vary.

2413. How deeply do you put the barley into the tanks; do you fill them full?—The cisterns are generally full.

2414. Can you give me the dimensions of one of those cisterns?—They are so very various, according to the quantity; some will steep only about 20 qrs.—I am not speaking of ours in particular—some will steep 20 qrs. and some 100 qrs.

2415. Take some of your own?—Some steep 70 qrs.

2416. What are the dimensions of a cistern that will steep 70 qrs., what length is it?—I really cannot tell you exactly. I believe 10 cubic feet will hold a quarter of barley.

2417. Do you malt wheat here as well as barley?—We do not, and I do not think it is malted in the town.

2418. What becomes of the liquid after the steeping?—It passes through the sewers into the river.

2419. Does it cause an objectionable smell at any time?—I think if it was passing through any length of sewerage, for instance, if it was passing through the town sewerage, that at times it would be objectionable.

2420. Fermentation would be set up, and it would smell badly?—Yes.

2421. There is nothing in that liquid that would be mischievous to vegetation if it was turned on to the land?—Rather otherwise, I should think.

2422. It would improve the sewage for irrigation purposes?—I think so decidedly.

2423. You are chairman of the highway board?—Yes, at present. I have been a member of the highway board for nine years out of ten since it has been formed. I have been chairman only during the current year.

2424. Did you hear the evidence given by your surveyor?—Yes.

2425. Are the facts that he stated correct?—I think there were certain facts that he did not attach sufficient importance to; I think he did not attach sufficient importance to the complaints that we, as a board, have received from individuals at different times.

2426. Have you received from individuals a greater number of complaints than he mentioned?—I think we have.

(*The Surveyor.*) I stated that some had been made to me; but that the principal complaints had been made to the board, which are entered on the minutes by the clerk of the board. I thought you were asking me about complaints that were made to me individually.

2427. Complaints might have been made without your cognizance?—Yes, of course I was aware of them, and I said that the minutes would show them.

2428. (*To the witness.*) Have these complaints been more frequent of late?—Yes, and they would have been very much more frequent had it not been in contemplation to effect some general system of drainage which would remedy the evil. I believe that the inhabitants have no wish to throw impediments in the way, and in consequence of this measure being in contemplation the complaints have been fewer. I believe that if it had not been we should have had a great many more serious complaints, and frequent applications to the board.

2429. Do you attribute the increase in these complaints to a larger quantity of sewage matter being passed into the river?—I think there can be no doubt about it; in the early part of the year there certainly was not so much, not nearly so much.

2430. Have the waterclosets been increased considerably of late years?—Yes, very much so.

2431. Within how many years?—They have been within the last five years very materially increased.

2432. Has the malting business carried on in Bishop Stortford increased of late years?—It has increased.

2433. Then the refuse from the malthouses and the sewage are both sent into the river, and both accumulate more or less matter in the river adjoining the town?—Yes. We have one very important street here called South Street, and the drainage lies upon a level with the river, and the consequence is that the accumulations in that sewer must be such as to be very detrimental to the health of the people. We had at the lower end of South Street last year several cases of fever, and several deaths from fever, and I have no doubt that medical gentlemen will be able to give you some evidence in reference to that. I believe, under our present system, that that street lies so low that it is impossible to get the accumulations out even into the river, so as to render that neighbourhood healthy, without adopting some improved system of drainage by carrying the sewage actually away. I may mention that this being a gigantic question it has very much for the present limited the action of the highway board.

2434. (*Professor Way.*) Do you know how soon you are likely to come under the Local Government Act?—I think in about a month.

2435. Have you sent in any plans or proposals in applying to be so placed under that Act?—No.

2436. Do you know that it would be useless to carry out any large sewerage works without a large supply of water?—Yes, that is my own idea, and I think it would be the greatest boon to our parish to obtain a large supply.

2437. (*Mr. Harrison.*) Have you not a mill in this town?—Yes.

2438. What is its fall?—About an average fall, I dare say, of five feet.

2439. What is the next mill to it?—The next mill belongs to Mr. Hunt, that is called South Mill.

2440. There the fall, I believe, is about five feet?—Yes.

2441. Is there not a mill at Twyford?—Yes.

2442. What is the fall there?—Something similar.

2443. That will make 15 feet of fall within a mile and a half of the town?—Yes.

2444. With such a fall there cannot be very much difficulty in getting the sewage of the town on to some land without any pumping?—The difficulty that has always presented itself to us has been the difficulty of getting quit of it after getting it on the land, or into the reservoirs.

2445. If you were to carry out a good system of sewerage, and carried your sewage away to the land, no reservoirs would be required; you might have a

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trap to catch all the heavy gravel and so forth, but the whole of the rest of the sewage might be passed on to the land day by day as it came from the sewer's mouth summer and winter?—But will the landowners receive it?

2446. You must make your own arrrangements about that. You ought to secure, either by lease for a very long term or by purchase, land to put the sewage on, and have it completely under your own control, so that the sewage should be put on to the land and purified before it passed into the stream?—That is a matter for our consideration.

The witness withdrew.

Mr. C. Barnard.

Mr. Charles Barnard (Harlow) examined.

2447. (*Mr. Harrison.*) Do you reside here?—No, at Harlow, but I own property in Stortford. Two sewers go through my property, one on one side of it and one on the other, in this street.

2448. You occupy some mills, I believe, in the town of Bishop Stortford?—Yes, and in the town of Harlow, but the property I own here is just below; there are two sewers running into the river from the town and they are most offensive.

2449. Do they run above or below it?—One below and one above the mill.

2450. Do you experience any annoyance from those sewers?—They are exceedingly offensive; in the summer time very much so. My men have been made ill by it at times.

2451. Are there many houses adjoining the river there, as well as the mill?—Yes; a great number all the way in the direction of South Street. The houses are very thick there.

2452. Those are inhabited houses?—Yes.

2453. You believe that the annoyance you find at the mill must be experienced by those people?—Yes; it is experienced by my men who work in the mill a good deal. The mill is right on the river, and the smell is most abominable at times.

2454. Have you known sickness to prevail among your men in consequence of that smell?—Yes; ast summer especially.

2455. The water in the stream, we have been told, is lowered very considerably in the summer time, is that so?—Very much so.

2456. Any sewage thrown into it must create a great nuisance?—A great nuisance. It not only does so here but it comes down to our place at Harlow where I have some land on the side of the river.

2457. You experience an annoyance, do you, from the sewage of Bishop Stortford at that distance?—Yes. I have a memorial here that we sent to the highway board in 1865 complaining of it, and I have the correspondence.

2458. The highway board have applied to have the town placed under the Local Government Act?—Yes; I know that they have.

2459. They are considering the question of carrying out a more thorough system of sewerage?—Yes; I have always said that they must come to that. The question would be a question of time, but the answer that they gave us was that they had not sufficient powers.

2460. If they carry out a system of sewerage and bring down more sewage into the river they will only increase the nuisance?—Yes. Some gentlemen have told you truly that they have sent men to work here; they have barges in the river for the purpose of raking up the sewage and sending it down to us below. We say that we have received it, but we do not very much like it.

2461. At the same time that they carry out a system of sewerage for the improvement of the town, it is necessary that they should take steps to pass the sewage on to the land?—Yes; that has been my opinion for many years.

2462. What is the fall at this mill?—Mine is a steam mill.

2463. Where do you get water from?—Out of the river, and we put it in again.

2464. What becomes of your ashes?—The ashes are sold. We do nothing but take the water out of the river, but all the condensed water goes back again.

2465. Have you any water power?—None at all.

2466. Is it generally the case where there are flour mills here, that they are applying steam power to them?—Yes, generally; there are several instances. I built two myself.

2467. So as to be able at all times to do a certain quantity of work?—Yes; at all times. I had a mill some years ago, a water mill, on the stream, and I put up a steam engine there, and when I gave the mill up I brought it away again.

2468. How do you obtain coals?—Sometimes by river and sometimes by rail.

2469. Have you found the competition caused by the railway to alter the price of coal at all?—Yes; it has cheapened it very much.

2470. How much per ton?—Something like from 5*s.* to 7*s.* compared with what we used to pay. We used to pay 23*s.*, now we get it by railway at 16*s.* or 17*s.*

2471. What quantity of coal do you use in a year?—About 10 tons a week.

2472. Five hundred tons a year, with a reduction of 7*s.* per ton?—Yes; which is a very considerable advantage.

2473. Has that reduction in the price of coal been enjoyed by the whole of the town?—Yes, by all.

2474. If they are obliged to use a little coal in pumping their sewage, the reduction in the price will be rather a benefit to them?—Yes, a very great benefit; the pumping is done so easily, and the machinery now is so good for pumping it. I know that it is very easily done.

2475. Have you experienced any annoyance from the malt works as well as from the sewage?—No. I do not think that the waste water from the maltings is of that deleterious nature as to cause any nuisance in the river. There is a little spirit in the water, but no great deal of sediment; now and then in the summer time there is sand. There is a little spirit in the water, but there is such a large amount of water that it does not pay to take the spirit out of the water. The barley is covered with the water; it lies under it for about 48 hours, and then the water is drawn off, and in that water there is a certain spirit or a certain gum, and that goes into the river, but it is not at all putrid or deleterious.

2476. (*Professor Way.*) It would become putrid if it was kept?—Yes, most likely; there is a sort of sugar that comes out from it.

2477. Does it get sour sometimes?—Yes; it smells rather sour in summer time, but there is not much malting carried on in summer time. There used to be, and the water was rather offensive, but now it is mostly carried on in the winter time.

2478. As a maltster you discharge your refuse into the sewers?—Yes. I let my malting business to Messrs. Taylor, but the water from my malting place goes directly into the river.

2479. You could discharge it into the sewers, could you not?—Yes.

2480. Supposing the sewage is diverted from the river, and the malting water goes into the sewers and is taken on to the land, will it do any harm?—Not at all.

2481. So that in fact that question will be dependent upon the question as to the application of the sewage?—Yes; I think there is land to be got just below the river. There is a great fall from the brewery; each side rises up very abruptly. On each

side there are deep gravelly slopes that would take almost any amount of sewage.

2482. Have you had any experience yourself of the application of liquid manure?—Yes; for the last seven years.

2483. Of what nature?—Where I live at Harlow, at my homestead, I have a great number of cattle of my own in sheds. We get all the liquid manure and run it into a tank shaped like that (*describing*), and after that I put in a wire grating, and take it into another tank, and then pump it out on to the land. I pump this two or three times a week on to the pasture, and in five minutes you cannot smell anything, although it appears to be putrid before it soaks into the land, which is porous. I have done this for the last seven years, and I think it has not cost me 5*s.* in seven years. It has been very effective.

2484. Then that experience would lead you to think that although sewage and farmyard liquid are not the same things, you could do the same thing with sewage as with the other?—Yes; you are aware of one case where certain operations in law took place.

2485. What was the case?—A certain kennel of hounds used to drain into my horse pond. It was just by my house. The drains ran from this kennel right into my horsepond, and it killed my cattle. Thereupon an action ensued, and we beat the gentleman, and now that sewage is taken and put into a tank and pumped on to his land; that has been in operation for several years, and it is now very effective.

2486. What is drained from the kennels is now pumped on to the land?—Yes, and it is offensive to no one.

2487. Do you know anything of that character in your experience which is more offensive than the drainage of those kennels?—There is nothing that I know of so offensive as that is. If you opened a small bottle of it in this room gentlemen could not stay here with any comfort at all.

2488. And that is now pumped on to the land without offence to anybody?—Yes; I took one or two gentlemen down there to see it, and it made them so sick that they were obliged to have some brandy before they could recover themselves.

2489. That was at the kennels?—Yes.

2490. Has anybody seen it when it has been put on the land?—After it was put on the land it made the grass grow so tremendously that they could hardly keep it down. In the early spring of this year it was so high that there was no such grass anywhere as where the kennel sewage was put. The dogs live a good deal on animal food, and the manure is very strong indeed, but the stench is very bad.

2491. Have you any land in the neighbourhood?—Yes.

2492. Have you any land which would take this sewage?—Yes; but I have none near Stortford.

2493. How far is it from Stortford?—Seven miles.

2494. Is it below Sawbridgeworth?—Yes; I should only be too glad to get it. We applied to the highway board from Harlow, and I got up this memorial to the gentlemen of the board of highways at Bishops Stortford.

2495. (*Mr. Harrison.*) When was that?—This was in June 1865. The newspaper has a report of it, which I will read. This is what I drew up, and it is signed by Mr. Pryer Field, vicar of Sawbridgeworth, William Barnard, Sawbridgeworth, R. Barnard, Harlow, Charles Barnard, Harlow, John Brickwell, Sawbridgeworth, Thomas Unwin, Sawbridgeworth, Frederick J. Unwin, Sawbridgeworth, Francis D. Beck, Sawbridgeworth, William Poole, Sawbridgeworth, surveyor, William Franklin, Sawbridgeworth, churchwarden, John Barnard, Sawbridgeworth, Henry James Bonner, Hallingbury, and William Death, Burnt Mill, and this is what they say: "To the "board of highways, Bishops Stortford, Herts. Gen- "tlemen, We the undersigned, being residents near "to the river Stort, beg to call your attention to the "increasing pollution of this river situated within "your district. There is at the present time so much "filth, ordure, and sewage entering the river from "the cesspools and main drains which have of late "years been constructed for the purpose of draining "the town of Stortford, that from this cause the "river has not only become very offensive to many "of the inhabitants of Stortford, but also to those "who reside some miles distant from the town (where "this foul nuisance arises); and we further say that "this nuisance is particularly offensive to some "of the inhabitants of Sawbridgeworth (through "which the aforesaid river flows). The foul effluvia "arising from this river in this parish is now very "offensive, and fears are entertained that it will soon "be very much worse unless some very efficient "method is adopted to prevent the Stortford sewage "entering and daily polluting the river Stort. Some "of the inhabitants of Sawbridgeworth and its "vicinity are about to convene a meeting for the "purpose of considering the propriety of sending a "memorial to the General Board of Health for "England, asking them to send a Government in- "spector to survey such parts of the river Stort as "are or may be considered injurious to the health "of the inhabitants residing near to the river. In "the mean time we shall be glad to learn that very "efficient means are speedily to be adopted to remedy "so foul a nuisance." That was the state of the river in 1865.

2496. Since that time the highway board have taken steps for the town to be placed under the Local Government Act?—Yes; I have a letter here which was received in answer to that application. It was written to my cousin. This letter was written by Mr. William Gee, who is clerk to the board, and it is as follows: "Bishops Stortford, 19 June 1865. Dear sir, I have "laid the communication received from you in refer- "ence to the pollution of the river Stort before the "highway board in accordance with your request. "The powers conferred by the Highway Act are in- "adequate to enable the board effectually to grapple "with the question. It is therefore, proposed to "convene a public meeting of the ratepayers for "Thursday the 29th June, at 10 o'clock, when the "matter will be taken into consideration."

2497. The highway board did take the step which they mention in that letter?

(*Mr. Miller.*) The highway board called the meeting.

2498. (*Mr. Harrison.*) And in consequence of that did you take steps to place the town under the Local Government Act?

(*Mr. Miller.*) We did take steps to gain additional powers so that we may do that which may be required, and which may be considered necessary, and in conformity with the Act of Parliament. We are the greater sufferers, of course, and we are anxious to get rid of the nuisance.

2499. (*Mr. Harrison.*) Are you expecting now to have a local board formed under the authority of the Local Government Act?

(*Mr. Miller.*) We expect it almost directly.

2500. (*Mr. Harrison.*) And have you heard that it is the wish of the town to take steps to improve the condition of things?

(*Mr. Miller.*) At a large meeting of the ratepayers and the inhabitants, I believe that it was unanimous.

2501. (*Mr. Harrison.*) (*To the Witness.*) Are you the owner of property in Bishops Stortford?—Yes.

2502. Besides the mill which you occupy?—Yes; I have malting premises near it, and a sort of market garden let to tenants.

2503. Have you any house property?—Two cottages for the labourers, situated near the malting premises.

2504. And you will not object to what is provided by the local board?—No; I think that it is the best thing which can be done, namely, to tax the town for the making of a very great main sewer, which I think might be easily carried out. I do not think that there is any engineering difficulty in the way; it is only a question of money, and that as far as I am concerned,

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having a good deal of property in Stortford, I shall be very happy to pay.

(*Mr. Miller.*) The Commissioners called very particular attention to the water sent from the malting cisterns, and it appears to me that they looked upon that as one of the greatest nuisances.

2505. (*Mr. Harrison.*) We only asked for information.

(*Mr. Miller.*) I did not state it at the time when I was being examined, but there is a very large brewery here, which of course discharges an immense quantity of sewage into the river, and there are also upon the banks of the river the gasworks.

2506. (*Mr. Harrison.*) (*To the Witness.*) Besides the sewers and the refuse from the malthouses, is there any other source of nuisance in the town of Stortford which you know of?—There are the maltings so far as they are a nuisance, but they are of course a very small nuisance. There is a brewery at the other end of the town, and from that I have seen a vast amount of sewage go into the river, such as brewers usually produce.

2507. (*Professor Way.*) You do not mean sewage, but a discharge of liquid of some sort?—It is very dark stuff.

2508. (*Mr. Harrison.*) In what part of the town is that brewery situated?—In the upper part of the town.

2509. Does that refuse, whatever it might be, pass right through the town?—Yes.

2510. And have you known objectionable matter to be passed from that brewery?—It looks very thick, and very muddy.

2511. Do you know what it arises from; is it from the cleansing of the casks?—I daresay that the gentleman who owns the property will give you that information.

2512. Are there also gasworks in the town?—Yes, right beside my property, and I have no means of going into the town without passing them; but the gentleman is here who has the management of the gasworks.

2513. (*Professor Way.*) Do you ever see any tar or anything of that kind floating upon the waters?—I cannot say that I have not seen tar, but the barges are a good deal tarred, and I cannot say whether it is from the gasworks or from the barges.

2514. Is it in any large quantity?—I never saw it in any large quantity.

2515. I suppose you know that tar is now too valuable to be wasted?—A great deal too valuable.

2516. (*Mr. Harrison.*) Besides being an owner of property in the town of Bishops Stortford and a miller on the banks of the river, do you farm any land in the neighbourhood?—Yes, about 500 acres.

2517. Is any of it situated in the valley of the Stort?—Yes.

2518. Is it liable to be flooded?—Yes.

2519. Is it benefited or otherwise by the floods?—Some of our land is very much benefited, and some of it is very much the contrary. When we get a surface of land like this table, and the water simply flows over it, and it soon gets dry again, the land appears to be very much benefited, there is a good deal of detritus left and a good deal of silt, and so on, and it makes the grass grow immensely. I have one field on the banks of the river, and that is very much injured by it.

2520. From what cause does that injury arise?—The water cannot get away, being dammed by the mill, and the land is constantly flooded. A few years ago, I could not grow any grass there of any value, and I dug the land and applied it to osiers.

2521. Had you any difficulty in passing the drainage below you?—Yes, the expense was so great that I would not encounter it.

2522. Are the proposed improvements in the river Stort proposed to be made in the neighbourhood of your farm?—No.

2523. That is lower down the river?—Yes.

2524. Is there much of the land in the valley of the Stort which is injured by the floods in a similar manner to what you have mentioned?—Yes, very much.

2525. Would a general system of arterial drainage be beneficial to the land in a very decided manner?—Yes, very much.

2526. Have any steps at any time been taken to carry out such a system?—Not a general system; there have been some local endeavours to put the land under drainage, and now and then, as Mr. Hunt was telling you, to put the water under another fall, and if you put it under another fall next to the mill, you can get good drainage, otherwise there has been no general system.

2527. Do you think that it would be a benefit to the land lying in the northern parts of the valley of the Stort, if the whole of the Stort basin were put under the authority of a board whose duty it should be thoroughly to drain the land, and to erect weirs, and to make the necessary arrangements for passing off the flood waters?—Very much indeed. I had a scheme, some years ago, and drew the plans myself for draining about 60 or 70 acres of land, which is now a mere swamp, and we could not carry it out, because we could not get everybody to agree to it. The land was owned by various people (I am now speaking of a large piece of land lying in and near Harlow Marsh), and we could not carry it out, because the land belonged to so many persons, that they would not all agree to the same thing, and therefore the land belonging to me is now in a swamp.

2528. Do you know that some few years ago, a Drainage Act was passed enabling such a work to be carried out, if a certain proportion of the owners of the property agreed to it?—Yes; but taking into consideration the amount of trouble and expense which it would be to us, we do not consider it worth while to enter upon it. At the same time the land would be very much benefited. I should think as much as a pound an acre.

2529. You think that the rent would bear raising to some considerable amount for the purpose of carrying out the improvements which you recommend?—Yes, I shall be very happy to pay 5*s.* per acre a year for my land to have it drained.

2530. Your experience of the working of the Land Drainage Act is, that notwithstanding the facilities which it affords and although it is desirable you have not been able to carry out the drainage in this district?—I am only speaking of this particular case. We saw so much difficulty in dealing with certain persons, that we dropped the matter at once, we did not go to any expense.

2531. Have you any facts which you can mention to us with respect to the diminution of the water in the river?—Some years ago, my farm happened to belong to some gentlemen who were conversant with the Land Drainage Act. My farm had a good many little springs on it, and they drained all these springs. Those little land springs used to remain till the summer, and used to go into the river, but now they all go away as soon as the rain falls, and that would diminish the amount of water in the river in the summer time.

2532. Is there no water passing in the summer time into the river from that source?—No, except we have a very heavy rain. In the winter time, of course, we have a great deal of water, and as much as we ever had.

2533. Do you agree with the former witness, Mr. Hunt, who stated that the quantity of water passing down is very much less now in the summer time than it was in former years?—Yes.

2534. Do you attribute that to the same causes as he did?—In some measure; but he did not mention the land draining which has been very extensively practised in our district.

2535. (*Professor Way.*) He mentioned that as one of the causes?—That I did not catch. That is one of the causes, and the other causes which he mentioned I have no doubt are very correct.

2536. (*Chairman.*) At what depth do you drain?—Many farmers drain about four feet deep.

2537. Is from four to six feet about the average depth?—Some people average 18 inches, and some two feet, and others three feet, and others four and five feet deep.

2538. At all events four feet would be a deep draining?—Yes, and I think that it is a great deal too deep draining on heavy land, but it is light land where my drains were made.

2539. With regard to the question of diminishing the quantity of water by draining, do you imagine that springs are seated in any section of land which is touched by four feet in depth?—Those are what we call land springs, we get them in at four feet.

2540. Supposing that something could sweep away the four feet of surface altogether, do you not think that you would have the same amount of springs as you have now?—That I cannot say.

2541. Do you not think that that spring water has connexion with a much greater depth than four feet?—These are very small springs. I will describe the nature of the land. We will suppose that there is a cup of clay, as is the case in some of my fields of two acres in extent, and in that cup there is a bed of gravel, the water cannot get away when it rains,—there it is. If you take a four feet drain through it, it goes nearly to the bottom of the gravel, and the water goes right away. As an example, I could point out a land ditch which generally begins to run in the month of November, and continues to run till about the middle of May.

2542. You can take away that water which rises to within four feet in depth?—Yes. I have spoken as to the effect upon my land and not the effect upon the river. It is only consequential.

2543. It takes away on your land water to the extent of four feet, and it passes it on to the river more quickly than it did before?—Yes.

2544. (*Professor Way.*) The instance which you give is one of the worst which you could select, because it is not the case of a spring but the case of water logged land. But supposing that you had a hill-side of gravel upon clay, the water would come out for months together, solely drawn from the superficial gravel, is that what you mean?—Yes. Sometimes the land crops out in gravel, and sometimes it crops out in clay, and what we call the four feet drains take a great quantity of water away.

2545. (*Chairman.*) Is there anything further which you wish to state?—No.

The witness withdrew.

Mr. Thomas Garratt (Hunsdon) examined.

Mr. T. Garratt.

2546. (*Chairman.*) Are you the proprietor of Hunsdon Mill?—I am the tenant of Hunsdon Mill.

2547. Where is Hunsdon Mill situated?—On the river Stort, about eight miles below Bishop Stortford.

2548. Down the river?—Yes. Roydon Mill is the mill below, nearer the Lee, which empties itself into Lee, it being upon the Stort, about four miles below Harlow.

2549. How long have you occupied that mill?—I occupied Roydon mill before I took Hunsdon mill; I have lived immediately on the Stort about 15 years.

2550. What number of stones can you ordinarily drive there?—There are six in the Hunsdon Mill, but the water of late years has come so irregularly that we frequently have water sometimes more than the mill will take, and at other times we have not more than enough for about two or three pairs of stones. It averages about three pairs of stones in summer, but now there are considerably more.

2551. Do you mean three pairs of stones, with cleaning and dressing machines?—No.

2552. Do you use steam power?—Not on the Stort, but on the Chelmer I do, where I have a mill in partnership with my brother.

2553. What is your fall?—Between 13 and 14 feet at Hunsdon. It is the highest fall on the whole river.

2554. What horse power do you use?—From about 24 to 26 horse power.

2555. What is your horse power when you have the least volume of water?—About 12 on the average. It is about half. I consider that I can do barely half as much in winter as I do in summer, because I am flooded in winter for days together. It is an overshot wheel.

2556. What diameter is your wheel?—14 feet 8, and it is about 12 feet high.

2557. Have you only one wheel?—Yes. I formerly worked two, but I had an overshot wheel put in lieu of a breast wheel some years ago.

2558. In what condition is the river ordinarily?—In a very bad state.

2559. Do you mean bad as regards the quantity of the water, or the condition in which the river itself is?—Both as regards the condition of the water, and the dirty state of the mud at the bottom, so much so, that about eight years ago it was a pure stream, and being in the habit of keeping trout where I come from in Hertfordshire, I introduced trout into the river, and I fed them till they were about 4 lbs. or 5 lbs. weight; but about four years ago the water came down in a green filthy state, and the whole of my trout died. The mud has come down by the barges. My water after it leaves the wheel is a private water for about three fourths of a mile to a mile, where there is no navigation, and the mud settles there to a great extent. I find that other people send the mud to me, and I had a large hoe constructed, and I put four horses to it, and I sent the mud down again into the navigation. It is cheaper than throwing it out.

2560. Can the persons below find any fault with you for doing it?—We occupy the mill below.

2561. What do you do at that mill below?—We drive the mud away in the best way we can. We have had iron harrows, with two or three horses. In some places a barge comes down on Sunday when my mill is stopped. The River Lee Company do not allow the navigation to be opened on Sunday, and the barges run up on the Saturday night to get to the mouth of the Stort before the river closes, and the others come down to get to the mouth of the Lee by the time that it is opened on Sunday night, and the mill standing still, there being no fresh water, it is just like a ditch, and the fish frequently come to the top of the water on Sunday from sickness.

2562. Has the condition of the river been getting better or worse since you have known it?—Decidedly worse.

2563. It is getting worse every year?—Yes. There is not a house near the river but what drains its sewage into the river the whole of the way up. Farmyards and other houses do so.

2564. In what condition do you occasionally find the surface of the water?—It is covered with green scum like a pond.

2565. Are there the carcases of dead animals floating on the surface?—Yes, frequently; and unfortunately, about three weeks or a month ago, I found the body of a dead child floating on the surface.

2566. When you find the carcases of dead animals, what do you do with them?—I push them through the gully hole.

2567. You do not bury them?—No; they would stink too much for that.

2568. What became of the carcase of the poor child?—I sent immediately for a policeman, and had an inquest held upon it.

2569. Was it found out where it came from?—No. There was an open verdict, "Found drowned." The child was about 24 hours old.

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2570. As the sewage of the towns and villages and of the individual houses comes in, do you ever see human ordure floating upon the water?—I cannot detect it.

2571. It gets broken up?—Yes, from the wheels disturbing it. It is at times more like churning up mud than anything else. I have frequently seen a barge come down and there has been a foot of mud. It shoves it down to the navigation, and there is a channel which drives it down to the head of the mill, and I am obliged to remove it in the best way that I can.

2572. Does it ever affect you or your men with sickness?—I have a pretty good constitution, and I do not think that it affects me.

2573. Where do you get your drinking water from?—From a well, and if the well is out of repair I send nearly a mile off for water for the use of the house.

2574. You do not think of drinking the river water?—Not in the least, and two years ago it was in such a state that my horses would not drink it, but that was only for a few days from the refuse of gas-works, or something of that sort.

2575. Do you think that it is a proper water to send on for the people of London to drink?—Decidedly not.

2576. If any improvement can be made so as to restore it to a pure condition I suppose that you think that it ought to be made?—Yes. The whole of the streams would be very pure water barring the pollution which comes in.

2577. If the springs were kept pure you think that the water coming to London would be pure water?—Yes.

2578. If they did that they would take certain water past your mills?—Yes.

2579. I suppose you would think that that should be compensated for?—I do not see why one individual should monopolise the whole to the detriment of thousands.

2580. I suppose that most of your mills are water mills?—Yes; those on the Stort.

2581. What is the rent of your mill?—The rent of my mill is 310*l.* a year with the land, and the tollage on the lock. I value the mill and the machinery with it, without the grounds, at 240*l.* or 250*l.* We have very good grounds. Nearly the whole of the machinery is mine, in addition to that.

2582. Any scheme which contemplated buying up the mills for the purpose of carrying out these improvements must face a very considerable outlay?—Yes.

2583. For instance the purchase money of a mill like yours would amount to a very good round sum?—It was purchased some few years ago.

2584. 5,000*l.* or 6,000*l.*?—It would not be worth that without the house and the grounds.

2585. If any scheme contemplated sweeping away the mills for the sake of a good water supply for London, it would come to a good round sum?—Yes; and I have always advocated that it would pay. The mills now are often flooded.

2586. An area of land is now back watered, and the annual value of water-logged land is much greater than the annual value of the power?—With the exception of a few instances in Hertfordshire, I consider that the mills cause more detriment to the land than they are worth. My family work two mills on the Lee and two on the Stort. My family occupy one on the river Ash and one on the Mimram.

2587. Is steam used at all in this part of the country for supplementing mill power?—On account of water falling-off some four or five years ago we hired another mill with 13 pairs of stones on the Chelmer to make up for it; six being worked by steam, and seven by water.

2588. Have you ever used steam for grinding?—I do so now on the Chelmer.

2589. Is there anything in water power which gives it an advantage in driving your machinery as compared with steam?—There is more wear and tear with steam power than there is with water power, because there is the friction, but in my opinion it makes very little difference if we had a full supply of water, cold water was the cheapest; but situated as we are, if we cannot do more than half our power, water power is very little cheaper than steam power. My family now occupy with water and steam upwards of 40 pairs of stones, and I think that 20 pairs of stones with steam would do more than 40 with water. When Monday morning comes and we make sales for 500 or 700 sacks of flour we know that we can do it in a certain time, but with water perhaps there may be a flood to-day and we are standing still, and to-morrow we have no water. At the mill at Hunsdon I have stood still for want of water at 9 o'clock in the morning, and before 9 o'clock next morning I have stood still from a flood, and that is within a fortnight of the present time.

2590. Then we have these facts; you find the river itself, you think, from some cause or another, to be more uncertain in its volume than it used to be?—Decidedly.

2591. You have the water getting much more impure than it used to be?—Certainly.

2592. You have greater deposits of mud than you had formerly?—Certainly.

2593. And you have large areas of land water-logged most injuriously by reason of the mill dams which are existing?—I do not think that at the lower part where I occupy, after a flood, if you lowered the river one yard, you could stop it from, at times, overflowing the banks.

2594. But you could easily bank the river in; you could raise a parallel bank which would keep the land from being water-logged?—I think that you must first of all see to the river the whole way. The Stort is the floodiest stream running into London. My water wheel is frequently from six to seven feet in tail water when I am standing still for a flood.

2595. Of what length is the weir?—About 22 or 23 yards in the widest part.

2596. If your mill were to stand in dry weather, what depth would the water come over it?—I frequently have to stand seven or eight hours when the water will not rise an inch. The other mills shut down at nights, and the water is frequently running over the banks for the whole of the day, and then the mill stands still after the others have stopped.

2597. What with the water wanted for the canal, and the water ponded by the other mills, and let down by the other mills without any consultation with you, you cannot tell what you will be able to do?—Just so.

2598. And yet the Stort is liable to very rapid floods?—I think that there is scarcely a river in England which is so subject to floods.

2599. Can you give me any idea of the height to which the river would rise in the middle of one of your ponds when it is in flood?—Our lands are frequently three feet under water besides what the gates will take.

2600. (*Professor Way.*) How much is the river below the banks?—Not more than about eight inches, but the valley is so low below that it fills the valley, it takes a sweep right down the valley, so that four-fifths of the water comes right down the meadows and over the roads.

2601. You know that very mischievous floods very frequently come down which you cannot control?—Just so. I do not think that you could construct banks high enough to carry them over, unless you went with the natural valley of the river. My mill is carried along a side hill, and when the banks overflow the valley is filled up. The original river Stort is now nothing but a dry ditch. I have no doubt that the old valley might be constructed to carry the whole of the water. If you swept away all the mills and opened the valley, you might carry all the water away without any difficulty.

2602. I suppose you need not sweep all the mills away if you replaced the water by steam?—You could not do that in the case of my mill at Hunsdon, it would be useless, for it is three miles distant

from a railway station. You had better pull down the mill and build it elsewhere.

2603. (*Mr. Harrison.*) You have two mills, one at Roydon and another at Hunsdon?—My brother-in-law lives at Roydon.

2604. Do you receive anything from the navigation?—Yes.

2605. How much do you receive for each lock of water passing the navigation?—Under the original Act it was 6*d.* a barge, and we had to let the barges through. After that, there was some arrangement with the proprietors of the river Stort and the mill-owners, that they should give 10*d.*, collecting a shilling, and should retain 2*d.* out of every shilling towards the labour of letting the barge through.

2606. At what mill is that?—At all the mills.

2607. A former witness stated that it was 6*d.*?—I have the 6*d.*, but I return one penny to the lock-keeper employed for the Stort proprietors; the 10*d.* and the shilling apply to the journey up and the journey down; there are two locks. I maintain that if there was a fair compensation for the loss of water I ought to have four times as much as the other mills do; it takes double the quantity of water to fill my lock that it does to fill the locks of my neighbours, and the water is of double the value to me.

2608. Is the 13 feet fall at your mill the same now as it was before the navigation was formed?—I believe that it is exactly the same.

2609. At what time of the year was it that the refuse which you have mentioned came down and killed your fish?—In the summer, in July and August. We always consider that there is the shortest water in the Stort as soon as the grass is cut, because there are so many ditches and water courses on the Stort which are affected after the grass has grown; there are a great many flags and, the sun having considerable power, they draw out the water into the atmosphere. When vegetation begins to cease we have more water.

2610. You have mentioned that the refuse collects; have you much of it in your tail race?—No, it is not so deep there; for the bed of the river is gravel and shallow.

2611. You mentioned that you obtained some water from a well, where is that well?—That is in my own house, and if the pump was out of order, rather than use the Stort water, I would send a mile for water to a spring.

2612. Do you think it desirable that the river should be put under some government, so that these evils which you speak of might be remedied throughout?—It wants some alteration.

2613. Do you think that it should be done at a system?—It would be for the benefit of the community at large. I think that it would be a detriment to occupiers of mills like myself, but for the community I maintain that it wants a different system altogether.

2614. Do you think with the last witness that the benefit to the land from the arterial drainage would be such as would bear the expenses necessary to carry out the improvements?—Higher up the stream it might be so, but with me as soon as the water is gone the land is so porous that I could plough it to-morrow, and it is so till you get to Stanstead marsh which Mr. Hunt has alluded to, and then it is bad. I consider that the floods are a benefit to me personally, but in places they are a great detriment.

2615. In parts of the river where rushes are growing, do you think with the last witness, that the benefit derived from arterial drainage would be equal to 1*l.* an acre?—I know the land which Mr. Barnard alluded to well, and it would be a great improvement.

2616. Is there much land in the valley of the Stort which would be considerably improved?—In Hallingbury it is very bad, it is a good deal flooded; but where I alluded to was on the Mimram, and there I believe that the mills are a great detriment. I refer to the neighbourhood of Welwyn.

2617. (*Professor Way.*) On the line of the Great Northern railway?—Yes, the Mimram is the purest stream which runs into London. I never knew that water the whole of the time fall below its banks. Whitwell is a place where nearly all the privies hang over the water, and in Welwyn the whole of the sewage runs in.

2618. (*Mr. Harrison.*) One of the former witnesses mentioned a number of mills which had had water power some few years ago, and which, in consequence of the diminution of the water, had been abandoned as water mills, are you aware that that is the case?—The water power is abandoned in this way: there is a mill which has been in my family for upwards of 50 years that is dry for three or four months at a time, but steam power is added to it; there are several mills in my family to which steam power is added. I maintain that the whole of the mills from Whitwell to Hertingfordbury, on the Maran or Mimram, do more harm than they are worth; there are about eight mills there, and I should think that the average of them do not make more than from 50 to 60 sacks of flour a week in the summer time. There are two mills on the river Lee which scarcely have any water; there are about 400 feet on the river Lee, from the source to the mouth.

2619. (*Chairman.*) That is from Houghton-Regis?—Yes.

2620. It is about two miles above Luton?—Yes; the mills have been dry for months together there in summer time. When I was a lad at home I took the height of all the mills from the source of the Lee, right down the Lee, and I calculated that there were about 400 feet.

2621. What is the number of mills?—There are about 12 or 13 mills on the river Lee above Hertford.

2622. In dry weather what amount of flour would those mills grind on the average?—Below Wheathamstead 100 sacks a week, and above Wheathamstead about 50 sacks.

2623. (*Professor Way.*) Do you know the river Stort and Lee sufficiently to give us an account in writing of the mills on them?—Yes, I know every mill from Luton to London, and every mill on the Mimram from the source to London.

2624. (*Mr. Harrison*) And the Bean and the Ash?—Yes, and I can give the fall to each mill. There is not a mill on the whole stream but what I have seen.

2625. (*Chairman.*) We shall be obliged to you if you will furnish us with that information?—I will do so.

2626. Is there anything which you wish to add to your evidence?—I think not.

The witness withdrew.

Mr. William Gee (Bishop Stortford) examined.

Mr. W. Gee.

2627. (*Chairman.*) What are you?—I am a solicitor, and I am clerk to the highway board of the town of Bishop Stortford.

2628. Under what authority is the highway board acting?—Under the General Highway Act of the 3d and 4th of William the Fourth.

2629. Then you have not adopted the new Highway Act for consolidating the previous enactments?—No, the parish of Bishop Stortford has just adopted the Local Government Act.

2630. What is the area of the parish?—I cannot state.

2631. Is the area of the parish and of the township the same?—Yes.

2632. Does the parish include a considerable acreage of agricultural land?—I really do not know, but I should imagine 2,000 or 3,000 acres.

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2633. Do you know what length of highways you have to maintain?—Eleven miles. We shall shortly have some more highways on account of the expiration of the turnpike trusts.

2634. When did you adopt the Local Government Act?—On the 25th of October, I think, and it will come into force on the 25th of December. I think that the time for appealing has now expired.

2635. Have you had any inspector down here?—No.

2636. Do you know what number of members you are going to elect as your local board?—Fifteen.

2637. You have settled that?—Yes, we have settled that at a meeting.

2638. The qualification will be settled by the Act?—Yes.

2639. It will be, I suppose, 500*l.* property, and 15*l.* rateable value?—Yes.

2640. You are under 10,000 in population?—Yes.

2641. Your population is about 5,000?—Something over 5,000.

2642. What have been the difficulties which have prevented your carrying out any sanitary measures as a highway board; have they been legal difficulties?—We object to any considerable outlay of money. I believe that at present we have no borrowing powers as a highway board.

2643. Are you pretty well acquainted with the Local Government Act?—I have had no practical experience of that Act.

2644. As a lawyer have you looked over its provisions?—Yes.

2645. Have you had any legal decisions as to what it can do and what it cannot do for you?—No, we have not gone into it generally. We have had two public meetings.

2646. Has the question been at all raised of the chance of excessive outlay?—Yes. I think that there is a fear on the part of the ratepayers that it may lead to a large outlay.

2647. Do you think that the ratepayers would be at all assured if they knew that an outlay which would be burdensome and would not give any benefit for the expenditure need not be contemplated?—I have endeavoured to impress that upon them.

2648. That if you manage your affairs as you ought to manage them, any rating or outlay will really add more than the money expended to the value of the property of the town?—Yes.

2649. If you have better streets you have better means of getting over them. If you have sewers and drains which are properly devised, you ought of course to have more comfort and better health, and less poor's rates?—Yes.

2650. And if you have a water supply you can give facilities which you cannot possibly possess where you have no water supply?—There is no doubt of that, but the great bugbear is a great increase of rates.

2651. Have you had any discussions amongst you as to what the sewerage might cost if properly executed?—We have had no definite estimate at all.

2652. Have you had any sum mentioned?—There was a scheme of drainage proposed in, I think, the course of last year, of which the estimated outlay was about 5,000*l.*

2653. That is about 1*l.* per head of your population?—Yes. It was rather an indefinite estimate; no particulars of measurements had been gone into.

2654. You have no debt, I suppose, now upon the township?—No.

2655. You expend the rates which you levy annually?—Yes.

2656. What amount of rate have you levied as a highway board?—Varying from 6*d.* to 10*d.*, and I believe that this year it has been 1*s.*, but I think that we shall have a little surplus from it.

2657. Are there any exemptions now from the rate?—No; we rate the whole parish.

2658. Does the land pay equally with the town property?—Yes; for all purposes of the Highway Acts. It is exempt from the lighting rate, with which, as a highway board, we have nothing to do.

2659. You have adopted the Lighting Act so far as enabling you to light the district?—Yes; there is a separate board of inspectors.

2660. Will all that be incorporated under your new local board?—Yes.

2661. At present where does the sewage of any drains or sewers which you have empty itself?—Into the river.

2662. Into the river which goes on to London?—Yes.

2663. Have you had any complaints from parties below, from millers, or owners of property, of the fouling of the river?—Yes. I think that the only formal complaint is the one which was brought forward by Mr. Barnard this morning. He read the requisition which he sent to the highway board. That was in the course of last year. That complaint was principally by the inhabitants of Sawbridgeworth.

2664. Complaining of the nuisance which is sent down to them?—Yes. At the same time they themselves drain into the river.

2665. And they send down the sewage to some one below?—Yes.

2666. So that if that system was general you would have people making complaints, and threatening actions all the way down?—No doubt there are great nuisances arising at times.

2667. Are there any privies situate in Bishop Stortford so as to overhang the edge of the river?—Yes, I believe that there are.

2668. Where the soil passes right away into the stream?—I believe that there are such; not a great number.

2669. But there are some few?—Yes.

(*Mr. Taylor.*) There are many.

(*Mr. Miller.*) There are many.

2670. (*To Mr. Gee.*) What measures have you adopted with reference to the nuisance of privies, or pigsties, or nuisances of any kind?—An inspector acting under the board has given notice to the parties in the ordinary way, and has taken such steps as might be necessary to remove those nuisances. A connecting drain may have been necessary; and in certain cases he has done that.

2671. How long have you had an inspector of nuisances?—All the time that I have been clerk to the board, and some years before.

(*Mr. Miller.*) From the formation of the board about 10 years ago.

2672. (*To Mr. Gee.*) What does he get per annum?—He is inspector and surveyor of the highways.

2673. What do you pay him for his services altogether?—60*l.* a year.

2674. What has been the general health of this district since you have known it?—I should say that it is a very healthy town as a rule.

2675. Have you had any outbreaks of fever?—For several years past there have been cases of fever, but I do not think that we have been more subject to it than the neighbouring villages and places of that sort.

2676. Have you ever had cholera?—I never heard of a case here.

2677. Has there been cholera at all in the neighbourhood at any period, above you, or below you?—Not within some miles that I know of.

(*Mr. Hawke.*) In the year 1834 I lost a relative by cholera.

2678. Were there any other cases at that period?—There was only one other instance of cholera, and that case survived.

2679. (*Professor Way.*) Was that case in the same year?—Yes.

2680. And there has been no case of cholera since that you know of?—Not that I know of.

(*Mr. Skipp.*) About ten or twelve years ago there was a bargeman who died of cholera in the town, and it was supposed that he brought it from London.

2681. (*Chairman.*) (*To Mr. Gee.*) Have you as a board anything to do with the house drains—do the parties make application to you for leave to drain into your sewers?—As a rule they are supposed to make

application to the surveyor, but I believe that the sewers are sometimes made use of without any application.

2682. Have the highway board made any new sewers since you have been clerk to the board?—Small additions have been made to the sewers.

2683. I suppose that you would not be authorized to construct what we should call sewers?—No.

2684. They would be drains to carry off the surface water from the roads?—That is no doubt the origin of the drains here. They have since been applied to sewage purposes. On the hills I believe that they answer very well for that purpose.

(*Mr. Miller.*) They are no more than surface drains for the roads.

2685. Of what shape are they?—They are circular.

(*Mr. Glasscock.*) They are all barrel drains.

2686. (*To Mr. Gee.*) As regards the Local Government Act, we may take it that you have complied with all the requirements. Have you received the assent of the Home Office?—We shall receive it when the time for notices of appeal has expired.

2687. And you have not received any notices of appeal?—No.

2688. (*Mr. Harrison.*) The surveyor was asked this morning with regard to the complaints; I think that you have brought the book in consequence?—Yes.

2689. Will you refer to a few of the complaints, so as to give us an idea of their character?—On the 1st of August 1863, "Mr. Marshall Taylor and "Mr. John Miller attended to complain of the "offensive state of the mill below the town mill. "After inspecting the nuisance in question it was "proposed by Mr. March, seconded by T. N. Miller, "and resolved, that the assistant-surveyor endeavour "to make arrangements with Mr. Davis, the superintendent of the Stort navigation, for the use of his "boat and implements to clear the filth from the bed "of the river between the town mill and the navigation, and also in the rear of the steam mill, and at "the outlets of the sewers." Then on the 28th of May 1864,—"Mr. John D. Taylor and Mr. Marshal "Taylor attended to draw the attention of the board "to the state of an open ditch in the rear of the "houses on the north side of Hockerill. A large "quantity of sewage and filth accumulated there, and "ultimately flowed into the brook running by the side "of the causeway, which was thus rendered very "offensive." A committee was appointed to inspect and report, "as to the most effective mode of remedy-"ing these nuisances." That ditch ran into the river.

2690. What steps were taken to remedy that state of things?—The ditches were cleaned out; that was the only thing which was practicable under the circumstances.

2691. (*Chairman.*) And then you had a new start, the same thing repeating itself?—Yes. On the 17th of September, 1864, "it was proposed by Mr. J. L. "Glasscock and seconded by Mr. Hawke, that steps "be taken to cleanse the bed of the river from Rye "Street, opposite Mr. Odams' house, as far as South "Mill Lock." On a show of hands there were three votes for and three against the proposal.

2692. What is the general character of the complaints; have they generally reference to the foul state of the river and the bad sanitary state of some part of the town?—They are principally as to local nuisances.

2693. In all cases they refer to some sort of local nuisance?—Yes. The old river at the mill tail is a very shallow stream, and several sewers are discharged there, and when there is a very short supply of water no doubt a nuisance occasionally arises there.

2694. As you have no power as a highway board to initiate proper works for the future prevention of that kind of thing, you are simply doing that which will require to be done over and over again. I assume that if your board complied with any of the requisitions, or set themselves to work to remedy the nuisance, it would be as bad as ever in a few months?—No doubt, and it would require removal again.

2695. It is a sort of up-hill work which will never end?—No doubt, so long as the sewers discharge there, there will be an accumulation.

2696. (*Professor Way.*) I suppose that small nuisances leading to complaints are not discussed and entered in your book?—Just so.

2697. Your book merely refers to matters of importance?—Yes, which are brought before the board. No doubt a great many of the small nuisances are obviated by the inspector.

2698. Then the general tenor of the book which is before you will be of the nature of important nuisances, and I suppose principally regarding the state of the river?—Nuisances which the inspector did not feel himself competent to grapple with without instruction from the board.

2699. (*Mr. Harrison.*) Without going specially into each case, will you mark the number of cases which you have taken out to bring before this Commission since the last date which you have mentioned?—I have not gone carefully through them. There was another proposal for dredging the bed of the river in October 1864. Steps at that time, I believe, were taken to remove accumulations. It is only in certain parts of this river that those accumulations form.

2700. From that time to the present have the complaints been numerous?—No; several of these cases are a further consideration of the same complaint. I do not think that since that time there have been more than three complaints made to the board as to the state of the river.

2701. (*Chairman.*) May we take it that your highway board has done all that they could within their legal powers?—I think that they have strained their powers.

2702. What number of members generally attend?—Six.

2703. How are they appointed commissioners; is there a qualification?—It is an annual appointment and they must be householders.

2704. Are they elected?—Yes; on the 25th of March.

2705. Are they elected by voting papers in the same way as the board of guardians are elected?—No, they are nominated in vestry.

The witness withdrew.

Mr. James Odams (Bishop Stortford) examined. *Mr. J. Odams.*

2706. (*Chairman.*) How many years have you known Bishop Stortford?—About 27.

2707. Do you reside in it or near it?—I reside in the parish.

2708. Are you a member of the highway board?—I am not.

2709. Has there been any reason why you should not have been so; have you not chosen to act, or have the electors not chosen to appoint you?—They have not chosen to appoint me. I think that perhaps had I put myself forward I might have been appointed, but my business occupations take me so much away from the town, that I could not very well devote the time to it.

2710. Have you noticed the state of the river during the period that you have lived in Bishop Stortford?—I have.

2711. Is its present condition better or worse than it was when you first knew it, as regards foulness?—I think that in the summer and autumn months the state of the river is decidedly worse, and must be of necessity

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worse than it was some few years ago, when I first knew it.

2712. I assume that there has been an increase of population in the valley?—There has not been a very great increase of population in the valley that I am aware of.

2713. What has occurred to cause the river to be in a worse condition that it was formerly?—The increase of sewage matter thrown into it from the drainage of houses into the stream.

2714. In former periods, I suppose, houses were not drained, and the filth lay around them, or in cesspools, but now they are drained and the drains end in the river?—Yes.

2715. And that has caused the extra pollution of the river?—No doubt of it.

2716. What is the character of the land below on either or both banks of the river?—It varies; there is some very good rich alluvial soil, and there is gravel very near.

2717. Is there any land upon which the sewage of the town could be beneficially applied?—I have no doubt that sewage may be beneficially applied to almost any description of land.

2718. Are there any parts of the town with which you are acquainted where there are nuisances existing such as at Providence Terrace?—I know Providence Terrace.

2719. Is there any cause of nuisance from that terrace?—Occasionally in the summer months. As I have walked from the town to my house, I have noticed an unpleasant odour from the drain which runs across the road to the river at that spot; and the drainage is from the Providence Row Cottages.

2720. What is that drain made of?—I believe that it is a wooden trough drain.

2721. How many houses constitute Providence Terrace?—Eleven.

2722. Does the sewage generally in the vicinity of the river, above and below, get into it in one way or another from houses and villages and places along the river?—I think so, from the whole valley of the Stort, but it does not do so immediately, it percolates through; but I have no doubt that it gets into the river.

2723. Have you taken any part in the movement for the adoption of the Local Government Act?—Not any active part.

2724. Have you considered the question as to whether it would be beneficial or otherwise?—Yes; I decidedly thought that it would be beneficial, rather than that we should be under the superintendence of a board of guardians who reside some distance from the town.

2725. Are you a ratepayer in Bishop Stortford?—I am.

2726. Then if any money is expended and if any rates are levied you will have to pay your share?—Unquestionably.

2727. And I suppose that you have not the slightest desire that there should be any unnecessary rating?—Certainly not.

2728. Have you seen at any time land under sewage irrigation?—Yes.

2729. Where?—I have seen the Craigentinnie meadows at Edinburgh; I have seen the Carlisle works, and I have seen a portion of the Croydon works.

2730. I suppose that at the Craigentinnie meadows you saw Italian rye-grass being grown?—I do not know that I saw Italian rye-grass. I saw a very coarse description of grass, but it was not the true description of Italian rye-grass.

2731. And at Carlisle you saw certain meadows irrigated, and cattle and sheep grazing?—Yes.

2732. What did you think of the grass there?—The grass was very coarse. I believe that it answered the purpose as far as the grazier who hired the land was concerned; but I think that the odour arising from the works was rather objectionable at Carlisle.

2733. Do you think that it was the odour from the sewage or from the proprietor's patent carbolic acid?—It was from a combination of the two, I should think.

2734. The person there professes to use carbolic acid to disinfect the sewage?—Yes.

2735. Have you ever been upon the ground after the sewage has been applied; have you smelt anything disagreeable after the application?—I have not been there immediately after the application, and therefore I have not smelt it. I am told that the inhabitants of Portobello at the present time are very much complaining of the nuisance from the irrigated meadows in the neighbourhood of Leith.

2736. That is near Edinburgh?—Yes.

2737. (*Mr. Harrison.*) When you were there did you go over the irrigated meadows?—I went over the irrigated meadows near to Leith. Not those running to Portobello. There are two portions of irrigatated land. I went over the irrigated land near to Leith. I saw the proprietor, Mr. Scurwin, who has been farming there for many years, and on that morning he had let one acre of his land for 27*l.* 10*s.*, and I was very forcibly struck with the enormous rental.

2738. (*Professor Way.*) Was that the rental of the grass?—Yes.

2739. That is to say, that the person to whom he let it had to take it away?—Yes.

2740. (*Chairman.*) That would be a Scotch acre, which is about one fourth larger than ours?—Yes.

2741. (*Mr. Harrison.*) Did you perceive the condition of the ditches on those irrigated meadows?—Yes, I noticed the ditches. Plots of land intersected the ditches, so that the sewage was put on upon every alternate day, or whenever they thought proper to put it on.

2742. When you visited the property, did you observe any of these ditches with stagnant sewage in them?—No.

2743. Did you perceive any smell when you visited the land?—None at all.

2744. If you had visited the meadows below towards Portobello you would have noticed many ditches which are large, and in which the sewage is allowed to stagnate, and I am satisfied, from inspection, that the nuisance from those irrigated meadows chiefly arises from the stagnant sewage?—I did not visit those meadows.

2745. (*Chairman.*) When you visited Carlisle do you think that you had anything more offensive than you have in an ordinary farmyard?—Decidedly so.

2746. When were you there?—I think that it was three or four years ago.

2747. The proprietor professes to make no stink at all except in his patent carbolic acid?—I believe that he does not.

2748. (*Mr. Harrison.*) When I was there I was particularly struck with the decided absence of smell. Whether the operation was a beneficial one or otherwise in other respects I will not speak so decidedly upon, but so far as the degree of odour from the works went, I thought that the absence of it was carried to a very great extent?—I certainly perceived a disagreeable smell.

2749. (*Chairman.*) When were you at Croydon?—It was three years ago. They had not carried out the plan in perfection there.

2750. Was it at Croydon or South Norwood that you saw the irrigated land?—It was at Croydon.

2751. (*Professor Way.*) I suppose that the power of the soil to deodorize sewage has its limits, and that you may put on so much sewage that the soil has not power to deodorize it all?—I of course bow to your superior judgment; but I should think that some soils would absorb almost any amount of sewage, but of course there must be a quantity running away.

2752. Supposing that the quantity of sewage put on at Edinburgh was more than in proportion to the area of land devoted to it, would not what I suggest be the case?—Yes.

2753. Possibly it is not necessary to repeat at other places what is done at Edinburgh, where comparatively few acres of land take the sewage of a very large population, and therefore that would not be any guide. We are accustomed to say that Edinburgh shows what can be done, but that it is far from a place to be imitated ?—Quite so.

2754. And that the evils of the sewage application there need not be necessarily repeated in any other place, and that therefore it is possible to deal with sewage in other places without any such evils, and that it is done ?—Yes.

2755. The case of Edinburgh is one for the enemies of sewage irrigation, and not for its friends ?—I think that it has a great many friends there in consequence of its success.

2756. (*Chairman.*) Do you know that one element of the dissatisfaction of the people in the neighbourhood of those meadows is that the proprietor is an Englishman ?—I was not aware of that.

2757. The most searching examinations and inquiries have been made in the neighbourhood of those meadows by constituted authorities; for instance, there are some large barracks there ?—Yes.

2758. And examinations were made by the War Office authorities, and the result was that it was found that the troops in those barracks had better health than in any other barracks in Scotland, consequently the accusation that the sewage caused ill health fell to the ground. I know that to be the case, because I was a member of that War Office Committee ?—It is very satisfactory to hear that statement.

2759. (*Professor Way.*) Supposing that it is made incumbent upon this town of Bishop Stortford to divert its sewage from the river Stort, and so from the river generally, which plan would your experience (having seen these places) dictate to you, the plan of precipitation of the sewage or the plan of direct application to the land ?—The plan of direct application to the land decidedly. I think that you had a statement in the evidence given by Mr. Hunt this morning, who told you that the effluvium from the precipitation at Hertford is very noxious, and that therefore the water of the stream must be polluted again.

2760. Have you ever seen the precipitating works ?—No.

2761. Would you be surprised to learn that it costs the people of Luton between 400*l.* and 500*l.* a year for precipitation ?—And when the precipitate is thrown down it is not worth carting away.

2762. (*Mr. Harrison.*) They get something by it ?—I should think that it is very trifling.

2763. (*Professor Way.*) At any rate they are at the expense of 500*l.* a year over and above what they get ?—Yes.

2764. (*Chairman.*) Anything which you precipitate out of washed sewage is of course of secondary importance for agricultural purposes ?—Yes; there is so little of fertilizing power left after the liquid has been removed, and in a commercial point of view it is a great loss to attempt to precipitate it.

2765. At Luton they get about seven tons a day of solid matter, taking six days in the week, which comes to an enormous weight of material, and that is principally road grit. They get nearly weight for weight out of the filter beds, but they put it upon the roads to make the roads, in the shape of stone ?—I think that we should be a good deal troubled by that here. I think that there are many people here who have a prescriptive right to drain into the river. If I understand the drainage of Stortford aright, the new drains are only enlarged old ones.

2766. Is there any further information which you can give us ?—I think not.

The witness withdrew.

Mr. John Poole Davis (Bishop Stortford), examined.

Mr. J. P. Davis.

2767. (*Chairman.*) You are surveyor of the Stort navigation ?—I am.

2768. For what length is the river Stort navigable ?—13½ miles.

2769. Where does it commence, and where does it end ?—The springs which form the source of the river commence about five miles above Bishop Stortford, in the neighbourhood of Elsenham.

2770. And it is navigable to what point on the Lee ?—It forms a small stream till it gets to Stortford. It is navigable from Stortford to a place called Field's Weir, near Rye House, on the Lee.

2771. The navigation begins at Stortford ?—Yes.

2772. What number of locks have you in that length ?—Fifteen.

2773. What is their fall ?—They average about six feet. The whole fall is about 90 feet.

2774. What tonnage can you get up that navigation ?—In ordinary times we carry from 45 to 50 tons. It depends upon the supply of water.

2775. Have you any idea what tonnage goes up and down in a year ?—Up and down our tonnage reaches nearly 60,000 tons.

2776. Is your navigation a separate navigation from the Lee ?—Yes, it is a separate property. The Lee is a trust, and the Stort is private property owned by individuals.

2777. Is it a company ?—It is a firm.

2778. Consisting of how many ?—There are five persons in the firm.

2779. Is it under Act of Parliament ?—The firm who have it now foreclosed a mortgage which they had upon it, so that they got it for a small sum, which is no criterion of the value of the property.

2780. How long have they had it in their possession ?—About 12 or 13 years.

2781. Do you know what the amount of the mortgage was ?—40,000*l.*

2782. For what length of time has the Stort been navigable ?—It was commenced in 1766 and was opened in 1769.

2783. Do you know who was the engineer who formed the navigation; was it Smeaton ?—No. I have not his name at this moment.

2784. Do you know whether Smeaton ever reported upon it ?—I do not know. I have only been connected with it for ten years. He may have done so in the earlier part of it.

2785. In what condition is the navigation now as regards its locks and permanent works; are they in a pretty good condition ?—They are in a very fair condition.

2786. Have you spent much money upon it recently ?—A great deal of money has been spent upon it in the last 10 or 12 years. This is a plan of the drainage of Bishop Stortford (*producing the same*). A great part of the drainage runs into the river before you come to the navigable part.

2787. You have been connected with the navigation for ten years ?—Yes.

2788. Is the pollution any greater now than it was when you first knew it ?—Yes, considerably greater.

2789. At what points ?—We have had two new drains made into the navigation during that time. One of those drains carries all the drainage from the union, and another drain brings the drainage from New Town, and they have added very considerably to the quantity brought into the river.

2790. As surveyor to the owners of the navigation, have you any power to stop drains being put in ?—We have no power which we can act upon. The power is very ill defined. We have on all occasions

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protested against drains being put in, and we have been in communication with the East London Water Works Company to try whether they would aid us in mitigating the evil, but they felt a difficulty in doing so, their Acts are not sufficient.

2791. What is the date of your oldest Act?—We have only one Act, and it is the 6th of George the Third, chapter 78; it was passed about the year 1765.

2792. Have you any dredge boats on the navigable part of the river?—Yes, two.

2793. What do you do with the material which you dredge?—We generally get rid of it to the farmers, some of them take it and spread it on their land, and find it very beneficial, and others dislike it.

2794. It breeds weeds, I suppose?—If you lay it in a heap it will breed weeds just as farmyard manure will, but not if you break it up.

2795. Have you any fish in the navigable portion of the river?—Yes, we have a very great many fish.

2796. Is the river affected by floods to any extent?—We have many floods, our highest floods rise from two to three feet, and they now go off very quickly; there is a system of drainage everywhere; they are more rapid than they used to be, and we get rid of them sooner.

2797. When a flood is at its height does it stop the navigation?—Yes, it stops it for a time.

2798. What distance on either side of the navigable portion of the river belongs to the proprietors of the navigation; do the towing path and the line of water alone belong to them, or have they any further right?—Generally our right only consists of the towing path, 14 feet from the edge of the river; we have much land belonging to the property.

2799. You have separate land belonging to the property?—Yes.

2800. Do you claim to have the right of soil of the bed of the river?—No; we can deepen and scour.

2801. Does it belong to the landowners?—It is supposed to belong to the landowners and the millowners, and so on.

2802. Do the mills belong to the proprietors of the navigation?—No, they existed before the navigation was made, so that the water was always dammed up.

2803. Can they interfere with your navigation; can they pull the water down when you want it?—Yes, and they interfere with us a great deal. We constantly have differences with them about their lowering the water so as to obstruct the navigation.

2804. Does that lead to lawsuits?—We have not been to law, we generally settle those matters amicably.

2805. If you can?—If we can.

2806. Your experience is that you are getting the river fouler than used to be the case?—Yes, in the neighbourhood of Bishop Stortford.

2807. In summer is it sufficiently foul in hot and dry weather to create an offensive smell?—Yes, very offensive.

2808. Do the boatmen ever complain of it?—Yes, all of them; it is very offensive.

2809. Is it offensive when you are dredging it?—Yes, in the neighbourhood of Bishop Stortford. In the very hot weather the sewage rises to the surface, and floats down the river.

2810. It ferments, and comes up in bubbles, and forms a scum on the surface?—Yes, we find that to be the case seven or eight miles down the river, before it is lost.

2811. Are you troubled at all with floating carcases of dogs and cats which are thrown in to be drowned?—Yes.

2812. Does the navigable portion of the river flood the valley on either side during floods?—Yes, the water overflows the valley on each side.

2813. Do your locks, tending to pond up the river water, flood any portion of the valley?—No, above the locks we have floodgates.

2814. At what height do you keep the water as compared with the adjoining land in the flattest parts of the valleys; have you not sometimes your water nearly up to the grass surface?—We regulate our water by the height to which the mills originally dammed up the water, the overshot fixed at that time formed the head of the water mark. Our rights to the water are limited, the mills having a prior right.

2815. Do the men who navigate the river use the water for cooking and cleansing?—They do in the lower parts of the river, but not in the neighbourhood of Bishop Stortford. Besides those at Bishop Stortford there are three drains into the river at Sawbridgeworth.

2816. Have you any list of the mills which there are upon the stream connected with your navigation?—Yes.

2817. Do you remember what their nominal power is, and what they do?—I do not, they are continually altering their power; we know the fall, and so on.

2818. Is the entire fall made available at one point or another all the way down, as far as your navigation goes?—No, we have 15 locks and only 11 mills.

2819. Then you could establish four more mills?—Yes, but we would much rather do away with those which exist than establish any more.

2820. (*Mr. Harrison.*) Have those four mills been purchased by the Canal Company?—No. In making the canal the length of water could be more cheaply dammed up by having additional locks.

2821. (*Chairman.*) Is the navigation fed by any considerable springs during its length which is navigable?—Yes, we have springs coming in all directions; there are very considerable springs about six miles down.

2822. Have you much more water coming down the river than is absolutely required for navigation purposes, and flowing to waste?—Yes, we have a good deal more than is required for navigation purposes. The mills are working constantly as long as they can go, very often night and day, and in addition to the water which they use we pass through from 800 to 1,000 barges each way in a year.

2823. And each barge takes its lock full of water?—Yes.

2824. And one lock full of water goes through the entire navigation?—Yes.

2825. Have you any side ponds to save the water?—No. We should be very glad to have them to save the water, but the works have been made in an economical manner.

2826. Have you any double locks?—No.

2827. If your trade increased you would consider them desirable?—Our trade has increased very considerably, but the increase has not been sufficient to cause us to make double locks yet.

2828. Have you felt the effect of railway competition?—For some years after the railway was opened the traffic upon the canal very much decreased, after that it took a turn, and in the last 11 years it has been increasing every year.

2829. What do you principally carry upon the navigation?—We carry corn, building materials, coals, and flour. We carry manure free of toll for the benefit of the farmers and landowners.

2830. Are you obliged to do that by your Act?—Yes. We also carry a great deal of artificial manure, such as oilcake and sundries.

2831. (*Professor Way.*) Do you carry timber?—Yes, a great deal of timber.

2832. (*Chairman.*) And malt?—Yes. We carry nearly 600,000 sacks of flour and corn in a year.

2833. What is your tonnage rate per mile?—We have no barges of our own. We only charge a toll upon the barges as they pass, and our average toll is about 9*d.* a ton.

2834. Is that for the entire navigation?—That is for the entire Stort navigation, and the river Lee trustees charge a further toll to London.

2835. Does that toll apply to boats, whether they traverse only a portion of the navigation or the whole of it?—No; the rates are proportioned according to the distance.

2836. Is your lock where you regulate the toll near the junction with the Lee?—Yes, it is the second lock from the Lee.

2837. What draught of water have you throughout the navigation?—About three feet six is the average depth.

2838. What are the dimensions of your locks?—They vary in length. They vary from about 104 feet to 90 feet, and they are 13 feet 6 wide.

2839. Then the barges, I suppose, are 13 feet barges?—The barges are about 78 feet long, and about 13 feet 1 inch wide.

2840. Are any of them worked by steam power?—No; they are worked by horse power.

2841. You say that your proprietors have no barges of their own?—They have not any.

2842. Have you ever tried steam upon the river?—No. We have hired steam dredging machines.

2843. But you have not had steam barges for towing purposes?—No.

2844. Have you seen any of the steam barges upon the Aire and Calder navigation?—No. I have seen them upon the Lee and upon the Thames.

2845. What is the ordinary width of your river?—It does not average much more than 35 feet. It is rather narrow for anything of that sort. There is no doubt that that is a very economical way of working barges, if you have room.

2846. At what velocity are the barges generally taken?—About two miles an hour.

2847. If you propelled one of your laden barges at the rate of four miles an hour, I suppose that it would give a great scour to the river?—Yes, it would injure the banks.

2848. And in some instances, I suppose, it would ground the boats—it would throw the water out of the river?—Yes. We have an advantage over the railway company in carrying malt, which is the great staple of this neighbourhood, because malt is a thing which, by friction, decreases in quantity. There is a saving of about $1\frac{1}{2}$ per cent. in carrying malt by water.

2849. That is to say, the motion in loading and unloading and the jarring friction upon the railway would cause malt to weigh less by $1\frac{1}{2}$ per cent. than in carrying it quietly by a barge?—Yes. Many of our malthouses are upon the banks of the river, and the malt is sent to the breweries on the banks of the Thames, so that a sack of malt has only to be lifted into a barge, and it remains quiet till it is taken out in London.

2850. Do you bring many coals up?—No; our trade in coals decreases as the railways get into the coal districts, but we have a certain trade still. Sometimes when freights are low we get more coals, and so on. Of course they come from the Pool. They are all the north country seaborne coal.

2851. Do you think that any plan might be devised for purifying this water more than it is purified at present without injuring the navigation?—My opinion is, that if the sewage of the towns upon its banks were not allowed to flow into the river there would be nothing to complain of. There is no hope for the river in any other way.

2852. It is the sewage which causes the mischief?—Yes, particularly the sewage of Bishop Stortford.

2853. How many bankmen have you upon that length of river?—We have about eight lockmen, but then we have a number of labourers.

2854. They keep the towing path in order?—Yes. The number varies.

2855. They move about?—Yes.

2856. What do you repair the surface of the towing path with; do you at all form the surface upon which the horses travel with gravel and broken stone?—Yes. We use unscreened gravel just as it comes from the pit.

2857. Do you get any gravel from the bed of the river?—Yes, occasionally, but it never binds; it is always loose.

2858. Because it is washed?—Yes.

2859. It has not sufficient loam in it to bind it?—No.

2860. Have any proprietors upon the river a right to dredge or to take material out of the river for their own purposes?—We always take out what we like.

2861. But do any of the owners of property do so?—No. No one else has claimed that right for many years, but our Act of Parliament does not say that we have any right to the bed of the river except for scouring and deepening.

2862. It only gives you a right to the navigation?—Yes.

2863. (*Mr. Harrison.*) We may take the locks to be about 100 feet long and 13 feet wide in round numbers, and the fall of the locks to average about six feet?—Yes.

2864. That would be in round numbers pretty nearly 50,000 gallons each lock full?—Yes, we average them at about 50,000 gallons.

2865. For a lockful of water, what do you pay the miller?—By the Act of Parliament we pay him 6*d.* For this he is required to open the lock on payment of 3*d.* for a lockfull of water, and 3*d.* is paid him for opening the lock itself.

2866. You have said that he gets 5*d.*, and that you have a penny for passing the barges?—Originally by the Act they took 3*d.* for a lockfull of water, and 3*d.* for opening it. By long usage they have got into the habit of taking the whole 6*d.*, and finding it more easy to take it by means of our lockmen than to send their own men to take the toll, they have adopted the plan of allowing the lockmen a penny in the 6*d.* for collecting this amount, so that they only get 10*d.* out of the shilling, but still they get 4*d.* more than the Act intended that they should get, unless they opened the locks.

2867. But in effect they get 5*d.* for each lockfull of water?—Yes.

2868. And for a barge going the length of your canal you have to pay 5*d.* at each of the fifteen locks?—One mill does not charge at all, there is 5*s.* each way paid.

2869. And the millowner gets 60 pence?—Yes; he gets the whole amount, and the terms which he makes with the lockmen whom he appoints for collecting the money are a private arrangement.

2870. You pay 1*d.* for 10,000 gallons of water?—Yes, a penny and a fraction, but according to the Act the payment should be only 3*d.* for 50,000 gallons.

2871. Have you the power of taking all the water, supposing that the traffic increased to such an extent as that you required it?—Yes.

2872. Could you by paying that rate per lockfull divert the whole of the water from the mill premises of the valley?—There is no doubt we could. The miller is bound to open the lock when a barge arrives there, under a penalty of 20*l.*, and no limit is placed to the number of barges, so that I appprehend that we could take the whole of the water if it were necessary.

2873. Making a payment to the millowner?—Yes, 3*d.* per each lock.

2874. (*Professor Way.*) In case you come to loggerheads with the millers you could not keep running the barges up and down?—No. A court of equity would no doubt prevent that.

2875. (*Mr. Harrison.*) For getting a boat down and back again, you pay 2*d.* per 10,000 gallons?—One and one fifth of a penny each way.

2876. You mentioned that a number of these sewers (*pointing to the map*) had been put in of late years?—Two of them.

2877. You heard Mr. Odams mention just now, that he claimed for the inhabitants of Bishop Stortford some vested rights, do you think that they would have any vested right in these new sewers?—I should say that they would have a vested right in the old sewers, but not in the new ones, and therefore when the new sewers have been put in we have protested against them.

2878. Besides these new sewers which are put into the river, is there not a considerable scour washed down from the soil into the basin of the river?—A great deal

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is washed away from the banks; the banks are continually wasting, so that a great deal of soil gets in in that way.

2879. Have you any account of the number of tons, much you have dredged out in past years, has it been an increasing quantity of late years?—The firm who now own the navigation have only had possession of it for about 12 years, which is hardly long enough for comparison. It depends very much upon the season; if we have a rainy season, we take very little out; if we have a dry season, we are obliged to take a great deal out.

2879*a*. That would rather point to its being to a great extent the sewage matter which you have to get out, is that so?—We always find that there is an accumulation at the mouth of the sewers, and we find that at Bishops Stortford it fills up much more than at any other part of the river.

2880. (*Professor Way.*) You have mentioned that there is a decrease in the quantity of the malt by carrying it by railway?—Yes, in the measurement by the bushel.

2881. That does not mean by weight?—The lost particles of malt diminish the weight.

2882. Do not they remain in the bag?—Yes, but they are not used in making beer.

2883. Does the malt sell for less money?—Yes.

2884. Practically you know that that is the case?—I have been so informed by maltsters in a large way of business. Some maltsters make the difference the amount of the rent of the malthouse, and others say that it is about 1½ per cent. The ordinary load of one of our barges is 600 sacks of pale malt, or 800 sacks of brown malt. The loss in this quantity if carried by railway would be nine sacks of pale or 12 sacks of brown malt, when the malt passed the meters in London.

2885. From what does it arise?—It is from the carting of it into the station, and the shaking of it in the train, and its being carted again.

2886. (*Chairman.*) You have been asked with regard to the quantity of the dredgings which you have taken out of the river; has the same amount of power been used within the last two or three years, between the town of Stortford, and the South Mill as has been used in previous years; have you used the same exertions to cleanse the river between those places recently as you have hitherto done?—We keep an account of the quantity taken out of the river, but it is very difficult to answer a question of that kind in a general way. If you asked me the difference between the quantity taken out in 1855 and the quantity taken out in 1865, I could, perhaps, state it from my books.

2887. But you can state whether your expenditure between Stortford and South Mill in the last three years has been as great as, or greater, than it was previously?—I should say that in the last three years we have not taken out so large a quantity as usual.

2888. But you have been understood to say, that the sewage of Stortford has very much increased?—The town has had it under consideration on several occasions lately to clean the river in the neighbourhood of the town itself, and on one or two occasions I believe it has been ordered to be done, but has been postponed, and that has rather hampered us in our arrangements; besides which, as the town has insisted upon putting drains in against our protest, we have felt it desirable not to do work which we should do under other circumstances.

(*Mr. Miller.*) Mr. Davis will bear in mind that the highway board have requested applications to be made to the navigation company as proprietors to assist them, which applications they have resisted from time to time.

(*Witness.*) We protest against these new drains, and they keep insisting upon putting them in, and then they ask for 100*l.* from us to take the deposit out of the river again.

2889. (*Chairman.*) We have this broad fact, that the sewage gets into the river, it causes a nuisance, it occasions a deposit, and the river people have more or less to take it out?—Yes.

The witness withdrew.

Mr. W. R. Hawkes.

Mr. William Robert Hawkes (Bishop Stortford) examined.

2890. (*Chairman.*) You are a maltster and brewer?—Yes, and a wine and spirit merchant.

2891. Where is your brewery situated?—In Water Lane, Bishop Stortford. It is sometimes called Back Lane.

2892. What quantity do you brew?—From 8,000 to 10,000 quarters.

2893. Where do you obtain the water for brewing?—From an artesian well on the premises.

2894. Does that artesian well go into chalk?—Yes, ultimately into chalk.

2895. Of what depth is it?—210 or 220 feet.

2896. Is it truly artesian, does the water rise above the surface?—It is not truly artesian.

2897. It is a bore hole with a well on the top of it?—I should think so; it was made many years ago, before I was connected with it, and therefore that is a question which I cannot answer, but I understand that in a well which is strictly artesian the water flows to the surface, and over the surface from the orifice.

2898. What volume of water per day do you pump from your well?—I cannot answer that question. When we are refrigerating, for instance, probably three barrels a minute would pass through.

2899. How many gallons are there to a barrel?—Thirty-six.

2900. (*Professor Way.*) That is for the surface refrigeration?—By passing cold water.

2901. By pipes?—Yes.

2902. (*Chairman.*) Is the water good water for your purposes?—The water is hard, but there is a difference of opinion, which has been expressed here to day, amongst brewers and others, as to whether hard or soft water is better or worse.

2903. Does not it rather more depend upon what you want to brew; whether you want to brew dark coloured ale or light coloured ale?—I have no doubt that soft water would extract more colouring matter than hard water.

2904. Is not the Burton water hard?—I suppose so.

2905. What number of men do you employ upon the premises?—From 30 to 40 of all grades.

2906. Have you privies?—There are two privies; they adjoin.

2907. Where does the refuse from the privies go?—Into the river.

2908. Have you many horses?—Yes.

2909. Does the drainage of the stables go into the river?—No, I should think as a rule not; some of it undoubtedly does.

2910. Where does the waste water from cleansing the utensils and barrels go?—It goes entirely into the river, but you know what the nature of that cleansing is.

2911. Do you cleanse a great many of the barrels by steam jet?—No.

2912. Is not that process used as a cleanser and sweetener?—Yes; we use it in some cases, but as a rule we do not make use of that apparatus.

2913. Have you formed any views of your own as to what should be done with the river to purify it?—I can scarcely say that I have. No doubt, from the refinements of modern civilization, which have resulted in the watercloset system, the river is worse than it was from more of the excrement getting into it; but what is going to be done with the river

I cannot say, and I have not gone a great deal into that question.

2914. Do you carry principally upon the river or upon the rail?—We principally carry by means of our own horses and waggons.

2915. You do not export?—No, not to any extent.

2916. (*Mr. Harrison.*) In pumping the water from your well, is the quantity which it delivers from the bore holes such that your pump does not much alter the level of the service?—That is a question which I cannot answer; it is all covered in.

(*Mr. Nash.*) When it was first done we could not lower the spring by applying three different appliances; there were hand pumps.

2917. (*Mr. Harrison, to the Witness.*) At what height below the surface of the ground did the water stand in the ground when the spring was first tapped?—When the well was made it was dug down into the chalk, and a seven inch cylinder was let down, and when they cut off the smaller cylinder the water flowed into the larger cylinder which we call the well. When the pumps were applied to it, we could not reduce the head at all, it was an immense quantity of water.

2918. What height was it?—It was about 20 feet below the surface, but that is not very much from the level of the river.

2919. (*Chairman.*) What was the size of the bore hole by which the water came up from the chalk?—About nine inches, but I am not sure about that.

2920. You are sure that it comes from the chalk?—Yes; I should think that it is about 150 feet in the chalk.

2921. (*Mr. Harrison.*) Do you know the level at which the water stands in that well at the present day, as compared with what it stood at after the completion of the works?—No, we have had no opportunity of judging of that.

2922. (*Chairman.*) For anything which you know, I suppose that it is at the same level as when you first started it?—Yes, as far as we can judge.

2923. (*Mr. Harrison.*) The information which we have had to-day would go to show that it probably might stand at a lower level than it did?—Possibly it may.

2924. (*Professor Way.*) At what depth were your pumps put?—I do not recollect now, but we have never had anything like a deficiency of water since we have had that well.

The witness withdrew.

Mr. George Perry (Bishop Stortford) examined.

Mr. G. Perry.

2925. (*Mr. Harrison.*) You are the manager of the gasworks in Bishop Stortford?—Yes.

2926. How long have you been so?—About 24 years.

2927. How long have the gasworks been established?—Since 1835. They have been twice enlarged during my supervision. They are situated at the south end of the town on the banks of the river Stort. I should think that the site is about one third of an acre.

2928. Is there any refuse from the gasworks which passes into the river?—None whatever; we have not a single drain at this time communicating with the river, neither have we had a foul water drain communicating with the river in the last nine years. I had it nine years ago, but in consequence of the frequent complaints of persons living on the banks using the river, and other persons, I cut it off, since that time I have evaporated the foul water under the ashpans.

2929. So that now you can positively state that no foul matter passes into the river from your works?—None whatever, except what is occasioned by the ordinary rainfall washing our premises. It is impossible to keep the yards and places exempt from ammonia, and when there is a rainfall a small quantity of the surface water will find its way down into the river. If we turned the ammoniacal liquor into the river and had a disposition to conceal it we could not do so, because it would be patent to everybody who passed by us. If the waste was turned into the river it would render the water from the works opaque all the way down to South Mill. If you take a tumbler of clear water and only take a straw and dip it into ammonia and put it into the water it will become opaque.

2930. All the products of your gasworks are now so valuable that there is an abundant demand for them, and you dispose of them?—We find it rather an expensive thing for us to store the ammoniacal liquor. We, of course, store our tar as much as we can. A great deal of it is used for rough buildings and agricultural buildings.

2931. (*Professor Way.*) And for boats?—Yes, some of it for boats, but the great bulk of it is taken away for making creosote and other articles in London.

2932. (*Mr. Harrison.*) When it is used on boats, is it not mixed with pitch?—I think that it is rather mixed with Stockholm tar.

2933. Would it be liable to defile the water?—Whenever the vessel passes up and down the river it breaks out in a few illuminated particles on the top of it, and that is the result.

2934. Then you think that any person observing that kind of thing upon the river might mistake it as coming from your works, whereas it possibly comes from a barge?—Yes.

2935. (*Chairman.*) What number of retorts have you now?—21 at work.

2936. What is your make of gas?—About 6,000,000 cubic feet in a year.

2937. What weight of coal do you use?—About 600 tons.

2938. At what price is gas selling here?—5*s.* per 1,000 cubic feet.

2939. For private consumption?—Yes.

2940. And are the lamps by agreement?—Yes, 3*l.* 6*s.* 8*d.* a year each, the company supplying the lamp and keeping it in order, and lighting it and putting it out.

2941. And do you supply the post?—Yes. That I believe is a cheaper rate than gas is supplied at under similar conditions in any town in England, or in any town in this part of the country.

2942. The gasworks belong to a company?—Yes.

2943. (*Professor Way.*) That is 5*s.* a head upon the population for that quantity of gas?—Possibly so.

2944. (*Chairman.*) I assume that gas is used very largely in the malthouses?—No, it is only used for the purpose of lighting.

2945. (*Mr. Harrison.*) From what quarter do you get the coal?—From Newcastle.

2946. How is it brought?—By the navigation.

2947. It is brought to London and up the canal?—Yes.

2948. What is the price of coal now as compared with what it was when you first were manager of the gas works?—I do not think that we are paying as much for it now as we did by 4*s.*

2949. Do you give the railway company credit for that reduction?—I do not know; I think that the

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price was reduced before the railway came into operation.

2950. What is the price now per ton?—About 16*s.* 6*d.* in the river. I refer to the price in London.

2951. What is the price of coal now in Bishop Stortford as compared with what it was when you first became manager of the gasworks?—I do not recollect what it was, but my impression is that it is not more than 4*s.* less.

2952. (*Professor Way.*) You have been manager of the gasworks for 24 years?—Yes.

2953. At what time did you begin to preserve the tar; you, I suppose, threw the tar into the river at one time?—It never found its way there unless it was once by accident; it has been most carefully preserved. I myself have sold a barrel of tar for 12*s.* 6*d.*

2954. What does a barrel weigh?—It contains about 28 gallons.

2955. We hear that a ton is worth about 1*l.* in the north?—I have sold three gallons of it for 1*d.*

2956. In other rivers the tar was thrown into the river, after an Act was passed to prevent it?—I should think not, because it was of such great value.

2957. But possibly you had a consumption for it; did you at any time throw it in?—We never did.

2958. (*Chairman.*) Had you a sale for it when you were first connected with the works?—Yes. I think that there is evidence from the gas company's books which will show that the tar has been sold for 12*s.* 6*d.* a barrel.

2959. What do you get per ton for your coke here?—We sell it by the chaldron, 12*s.* a chaldron.

2960. Have you a ready sale for all that you make?—Yes, a very fair sale.

2961. Do you use most of it for your own purposes?—We use fully one third of it.

2962. Then you have two thirds for sale?—Yes.

2963. What dividend is your company paying?—We have paid 7½ per cent. for the last three years.

2964. (*Professor Way.*) Do you get any of your coal by rail?—No, except in one instance.

2965. Do you think that you could get it cheaper if you contracted to get it by rail?—I am not aware of it.

2966. (*Chairman.*) The canal company puts your coals alongside your yard, you have a wharf alongside the side of the river?—Yes, our works are better adapted for the reception of coal by water than in any other way.

2967. Is there anything farther which you wish to add?—Nothing, except that I hope that every publicity will be given to my declaration, and I almost wish that I was allowed to make it upon oath, because I have been so strongly suspected and charged with foul practices upon the river. I take this opportunity of publicly declaring that we have not a single drain flowing into the river, and that for the last two months there has not been a single surface drain from our works flowing into the river, but for nine years our foul drain has been most effectually cut off.

(*Mr. Miller.*) We have an instance in our minute book of the highway board where we had to draw attention to a nuisance from a ditch from the overflow at the gasworks and which was of a most abominable character, and there is always found in the neighbourhood of the gasworks a great nuisance. I do not know how the gas company get rid of their nuisance, whether it is by absorption or by fire from the ash-pits, but we all know, living in that district, that we are very much annoyed.

(*Witness.*) When the foul lime from our works, which is strongly impregnated with sulphur, has accumulated in consequence of not being removed, a heavy rain produces a smell.

2968. (*Professor Way.*) Then you acknowledge that there is a smell, whether by your act or not?—Yes.

2969. Is it possible to make arrangements for that lime to be taken away, and if not bought for you to take it away?—We should not then go to the expense of it.

2970. (*Chairman.*) Cannot you purify it?—No, I do not like the oxide of iron.

2971. Have you never tried it?—No; the late Mr. Mr. Gripper, who was a large shareholder in the Hertford gasworks, where they had adapted their gasworks for oxide of iron, recommended me not to do it.

2972. But is his opinion to be put in opposition to the opinion of the managers of the great gasworks in London, all of whom use oxide of iron?—I have had communication with the City of London Gasworks, and there I think they use dry lime.

2973. They are all altering it into the oxide of iron?—I do not like it.

2974. Have you any children brought into your purifying house when they are suffering from croop or whooping cough?—I have only had one instance of it. A lady brought children down there about two years ago; she paid but one visit to us; she wished to be there when the purifier was opened. I did not go into the place myself, but I think it was too strong for them; they never repeated the visit.

2795. (*Mr. Harrison.*) Was that visit of any use?—I did not hear the result.

The witness withdrew.

Adjourned to To-morrow at 11 o'clock, in London.

Victoria Street, Saturday, 15th December 1866.

PRESENT:

ROBERT RAWLINSON, ESQ., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, Esq. | Professor JOHN THOMAS WAY.

Mr. JAMES MUIR, further examined.

2976. (*Chairman.*) At your last examination certain documentary evidence was required which you promised to supply?—Yes; and the first that I promised was an abstract of analyses, by Dr. Letheby, o the water supplied by the New River Company during the year 1866. I have that abstract here, with a detailed return of the last-mentioned analysis.

2977. Have you any other returns to hand in?—Yes; I have also a statement of the quality of the Hertford sewage. A detailed analysis by Dr. Letheby has not yet been made.

The following papers were handed in:

ABSTRACT of ANALYSES, by Dr. LETHEBY, of the Water supplied by the New River Company during the Year 1866.

Month.	Amount of Organic Matter in Grains, per Gallon.	Saline Constituents in Grains, per Gallon.
January	0·30	21·10
	0·40	20·60
February	0·40	20·40
	0·40	20·80
March	0·30	19·80
	0·20	21·20
April	0·20	19·80
	0·20	18·80
May	0·20	17·60
	0·30	18·60
June	0·30	17·90
	0·20	15·90
July	0·16	17·90
	0·20	16·96
August	0·24	17·15
	0·22	16·87
September	0·52	16·80
	0·21	16·17
October	0·28	17·84
	0·31	18·56
November	0·52	20·57
	0·52	19·46
December	—	—
	—	—
Average	0·29	18·67

The samples analysed were generally described as bright and colourless.

DETAILS of last-mentioned Analysis:—

	Grs. per Gall.
Carbonate of lime and magnesia	13·26
Sulphate of lime	2·91
Alkaline chloride	1·02
Alkaline nitrate	1·97
Silica and alumina	0·30
Organic matter	0·52

The samples were perfectly bright, and free from organic tint.

QUALITY of HERTFORD SEWAGE.

The whole amount of suspended matter in the discharge of the Hertford sewers, when least diluted, has been found to be little more than 6 grains per gallon.

Precipitating by about 2 grains of lime per gallon, and filtering through fine gravel, reduced the suspended matter of the said discharge, before its delivery into the Lee, near Ware, to 2·3 grains per gallon, of which 1 grain was *mineral*, and 1·3 grain *organic*.

On the advice of Dr. Letheby (who was applied to on the subject in August last) the proportion of lime employed was increased. It is now *three times* its former amount.

Analysis by which it is intended to ascertain precisely the effect of this additional application of lime has not yet been made.

It is mentioned in the paper last handed in that the examination of the sewage took place at a time when we were using a comparatively small quantity of lime; in August last we applied to Dr. Letheby on the subject generally, and asked him what deodorizers he recommended most, and he stated that he thought we could not do better than increase the quantity of the lime, and the quantity has been increased threefold.

2978. (*Professor Way.*) You now use six grains of lime per gallon instead of two?—We are now using $7\frac{1}{2}$ grains.

2979. (*Chairman.*) Have you seen the deodorizing works at Luton?—I have in a general way some time ago, but I have not minutely examined them.

2980. Have you any control at all over them?—None at all, except by way of complaint. There is that amount of control, which the company has exercised (as I explained on the last day of my examination) more than once.

2981. Your company has not in any way contributed to the efficiency of those works, nor interfered with them?—No, except by calling upon the Board of Health to do their duty.

2982. Are any periodical inspections made of them to see whether they are doing their duty?—I have sent for and procured specimens of the water as it flows from their works without their knowledge.

2983. Have you had any analysis made of those specimens?—No.

2984. Will it not be in future advisable to make periodical examinations and analyses of them, and have them recorded?—Yes.

2985. Can you form any idea as to the amount of the impurity and the kind of impurity that goes into the river at that point from Luton and all the manufactories there?—A great deal of impurity must pass into those deodorizing works, but I have had specimens taken of the water as it has flowed out of the works after being treated, and those specimens were not generally to be complained of from their appearance.

2986. Do you know of your own knowledge what weight of chemicals are used in Luton in the processes of bleaching and dyeing?—No.

2987. (*Mr. Harrison.*) I believe they adopt at Luton the same system that you do at Hertford for deodorizing the sewage?—Yes, but I understood the Chairman's question to refer rather to the impurities.

2988. (*Professor Way.*) Are you aware generally that the precipitating process only throws down the matters already in suspension, and that it does not remove the matters in solution?—I am aware that it does not.

2989. The $7\frac{1}{2}$ grains of lime that you have spoken of would not be enough, I presume, to soften the water?—I think not.

2990. Consequently it is not enough to precipitate lime in solution in hard water?—No.

2991. Therefore it will not throw anything down but the suspended matters?—No.

2992. It is merely a better means of clearing the liquid?—That is all; you will see that after the

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process was conducted some time ago with a small quantity of lime, there remained but one grain and three tenths of organic matter in suspension.

2993. Which you before explained?—Yes.

2994. (*Chairman.*) Have you any control over the sewerage of Bishop Stortford?—None at all.

2995. Do you know of your own knowledge what they have been doing there recently?—I do not.

2996. Do you know that their sewerage goes into the River Stort?—I know that it does.

2997. At Bishop Stortford?—Yes.

2998. The Stort is a tributary of the Lee?—It is.

2999. Is it in any way a tributary to your supply?—Yes; but the bulk of our supply, as I have already explained, or that portion of it which we take from the Lee, is drawn above the entrance of the Hertford sewage. We have legal power to take the water from Tottenham, and we have there a steam engine, but that is hardly ever exercised; the engine has not been at work there for two years.

3000. If there is any impurity passing into the Stort at Stortford, you would get your share of it?—Yes, if we pumped at Tottenham. The chief reason for having a station there was this, in times of very hard frost it has been found that the river channel, especially if there has been a heavy fall of snow, was apt to be choked up, and of course then it would be a convenient thing to fall back upon a source so much nearer home, and pump the water into the Stoke Newington reservoir. Practically we do not use the Tottenham source of supply, and therefore we are not affected by the Stort impurities whatever they may be.

3001. Did you before state how many springs you had control over?—I cannot say whether my enumeration was complete without seeing the notes.

3002. There is a certain number of large springs which you have under your control?—We have the Chadwell spring, a natural one, and several artesian wells sunk deep down into the chalk, which I think I mentioned before.

3003. Do those wells deliver water over the surface?—None of them do. In that sense they are not artesian wells. They are only artesian in the sense of being bore holes through an impervious stratum to reach the chalk below. In some of them the water reaches within three feet of the surface.

3004. If you carried a heading up to such wells as those, you would get a flowing spring?—We should, at a sufficient depth.

3005. That, I assume, would not be a very large volume of water as compared with the entire volume that you use?—I mentioned before that the Chadwell spring had this year delivered as much as 700 cubic feet a minute; I have, since my examination here, taken the average for the year, and it may be put at 500 cubic feet a minute; that is, of the Chadwell spring. I am not quite sure of the minimum, but it is something under 300 feet a minute.

3006. And what is the maximum?—It may deliver as much as 700 cubic feet. The artesian wells, or rather these chalk wells, yield very abundantly.

3007. When they are pumped from?—Yes.

3008. Would it be possible, if sufficient cost was incurred, to bring in a volume of spring water without any surface contamination at all by separate mains and gathering conduits?—The cost would be very great, I am afraid.

3009. Putting that out of the question, and rejecting everything that might stand in the way, abolishing the navigation, and taking possession of the water and bringing it in through brick conduits, do you think you could get a supply of spring water equal in volume to what you supply now from the other conduit?—If you call the water of the streams above Hertford spring water, we could; but if you exclude the River Lee, which is at present a partially polluted stream, and exclude also the Beane, which is not quite so pure as the Mimram, I do not think that you would get the quantity that would be requisite.

3010. I assume that these streams are themselves supplied by springs, and that any contamination they receive is after they issue forth and come into the open channel?—Yes, it is so.

3011. If cost were no consideration, I assume that that spring water might be collected in covered conduits, and brought down to a junction with the main arterial conduit, and so bring the water on to London?—Yes.

3012. Therefore, putting aside cost, and supposing that the object of this Commission is both to exclude from these streams all pollution, and to secure an abundant supply of spring water, what is your opinion?—I believe that the upper valleys of the Lee would furnish beautiful water, and sufficient in quantity for our present purpose, excluding the sewage.

3013. What is the present capital of the New River Company?—I answered that question roughly on my last examination from memory, but I will put in the Act of Parliament in which is mentioned the capital that was settled by Parliament in 1852,—exceeding a million and a half. The company obtained Parliamentary powers in 1852, and also in subsequent Acts in 1854 and in 1857, to borrow money to the extent of 1,000,000*l.* Last session again they obtained power from Parliament to increase their capital by 500,000*l.*

3014. The capital now may be considered as exceeding 3,000,000*l.*?—Yes.

3015. If such works as have been indicated or suggested were carried out, I suppose one might expect that there would be a much larger capital?—It would require a large increase of capital to execute works such as you have mentioned.

3016. I dare say you have seen the projects which have been laid before Parliament for bringing in water to London from enormous distances, from North Wales as one place, and I believe there is another to bring it from the lakes of Cumberland and Westmoreland. Looking at such schemes as these, it being contemplated to use covered conduits, as an engineer, knowing your own ground and your own river and its tributaries, do you think you would have to face anything like an equivalent expenditure to make your water supply as unexceptionable as could possibly be desired?—The expenditure in our case would be nothing like that in either of the other cases you have named.

3017. What you would have to deal with would be works not of a complex character; you would not have nature to control you in any way; you have a gradual fall all the way; you know all the difficulties you would have to encounter, and it would be merely dealing with trade property and proprietary rights as exercised upon the river now?—As a matter of engineering the works would be of the easiest kind.

3018. Looking at what London was when Sir Hugh Myddelton first projected his New River scheme, at its population, its requirements, and its means of contributing to a work of that class; then looking at London now, with its population, its requirements, and its means of contributing, without going into detail, do you think that such a work as I have suggested, viz., that the New River Company should collect spring water and bring it in covered conduits, and distribute it without any chance of contamination, would be a greater work in the present day than it would have been in Sir Hugh Myddelton's day?—I believe it would not be so great a work in proportion.

3019. Taking all the elements into consideration?—Yes.

3020. The population, its ability to pay, and its requirement of water?—I think it would not be so large in proportion.

3021. Looking back to Sir Hugh Myddelton's day, I assume you will agree that then the country was very thinly peopled, that agriculture was in a very rude condition, as compared with what it is now, patent manure was not used to so large an extent, and all the forms of pollution that existed then would have been trifling as compared with what they have grown to?—Yes.

3022. We have now a population growing far more rapidly than before, and taking all those circumstances into consideration, do you not think that it is necessary to deal with this question upon a liberal and great scale?—It is quite my own view that it is.

3023. In making these suggestions I always assume that your company would not have its property sacrificed, but that the company would be dealt with upon liberal terms?—It would be quite the feeling of the directors of the New River Company that some comprehensive scheme of that kind should be carried out, if they could only see their way to an adequate remuneration.

3024. That they shall be treated as honourable men dealing with honourable men, and that their property shall not be dealt with in a spirit of confiscation, but in a fair trading way?—Quite so; if fresh expenses are laid upon them in this way, some new arrangement would of course be necessary to make their returns in some measure proportionate to the additional outlay.

3025. Do you produce a general map showing your scheme of rivers and the area you supply?—Yes, this map which is on a small scale, does that.

3026. Will you put it in?—Yes (*handing in the same*). It shows the metropolitan area of the New River district, and I call it metropolitan, because the company can supply parishes along the course of the river, and this is the metropolitan area of that district (*pointing to the map*), which is coloured.

3027. You have coloured it pink?—Yes.

3028. You say that the company have power to supply the adjoining properties along the whole line of this conduit from Hertford down to the metropolitan area?—Yes.

3029. Have any applications been made to you by the adjoining parties for a supply of water?—Only those have applied who have residences near the river.

3030. The townships or parishes, I suppose, have not applied to you?—I think not; the town of Enfield has waterworks of its own, and that is almost the only town of importance upon the line of the river.

3031. Has Tottenham a supply of its own?—Yes, that is rather out of the line of the river. I may add with regard to Enfield that not only has it its own wells, but it has water from this portion of our river (*pointing to the map*). That loop is kept for their use, and from that loop they take water.

3032. Have you any other documentary evidence to hand in as to the rainfall?—I have gone through my rain gauge returns, and the one that I rely upon is one that I took in conjunction with Mr. Beardmore at Field's Weir, and he will put that in. The other returns are not in so perfect a condition as to enable me to furnish you with them at present, and I am afraid the returns would not be all that I could wish them to be. Another document which I have to hand in is an abstract of complaints made at the office.

The same was handed in as follows:

ABSTRACT of ENTRIES made in the "COMPLAINT BOOK" at the Office of the New River Company during the year 1866.

No.	
182	Complaints of short supply from defect in ball cock, lead pipe, or other apparatus belonging to the tenant.
23	Complaints unfounded, or unaccounted for, supply having been found on inquiry to be good.
19	Complaints of leakage, or other defect, in company's pipes, plugs, or cocks.
17	Complaints of dampness; found on investigation to proceed not from water pipes, but from defective drains, &c.
16	Complaints of waste at adjoining houses.
5	Complaints of want of water through breakage of pipes by sewer and gas excavations.
12	Complaints of want of water from mains or engines being off for repairs.
13	Complaints of deficient supply through service being given at a time of day when draught of other consumers reduced pressure in mains, remedied by serving at a different time.
42	Complaints arising from insufficient size of pipe or cistern, or from time of service not being equal to increased consumption.
3	Complaints of want of water through severance of pipes by adjoining owner.
8	Complaints of want of water where additional cisternage had been put up without notice to the company's servants.
6	Complaints of water being temporarily discoloured by the iron of newly driven pipes.
3	Complaints made to the company from houses not supplied by them.
1	Complaint of supply having been cut off for waste or non-payment.
3	Complaints arising from foul state of consumer's cistern.
1	Complaint entered in error.
1	Complaint caused by defect of meter.
1	Complaint caused by water having become fouled by ferrule defect.
1	Complaint of turncock not keeping proper time.
3	Complaints of want of Sunday supply; said supply given.
5	Complaints of want of Sunday supply; proved not to be required.
1	Complaint in regard to which the company's servants were not allowed to enter house to ascertain the cause.
11	Complaints through want of separate communication pipes.
1	Complaint arising from neglect of turncock.
3	Complaints caused by gas leakage into water pipe.
4	Complaints under investigation.
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3033. May this document be made use of?—I think so; we have no objection.

3034. Have you any other return to hand in?—I think not. I think what I have handed in includes all that were mentioned on the last occasion.

3035. (*Mr. Harrison.*) I see, by the return you have handed in, that three of the complaints arose from the foul state of the cistern of a consumer?—Yes.

3036. What control have you over the cistern of a consumer?—We have no direct control.

3037. By whom would the complaint be made?—By the consumer himself, who not having examined his own cistern, and not knowing its condition, nor the cause of the impurity of the water, applies to us; we examine it, and find out that something has got into it that ought not to be there, from the cistern probably being left uncovered.

3038. Not through the medium of your water, but from some external source?—Exactly.

3039. Do you put the cistern to rights in a case of that kind?—No, we only point out to the person complaining what it is necessary for him to do.

3040. In schemes that have been proposed to bring water from the Severn and from Wales, do you know whether it was proposed to carry the water throughout the entire length in a covered channel?—Not to be covered I believe throughout. Mr. Bateman in his report mentioned covering merely where it was necessary.

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3041. Does he explain at all what he considers that to be?—No, but I think he gives representations or drawings in his report of the kind of conduit that he intends in different places to construct; some are to be covered and some uncovered.

3042. Does he point out the cases in which he considers it will be necessary to cover them on account of situation or other cause?—I think not.

3043. Do you think that if you were to collect the spring water above Hertford in different directions, and brought that spring water to the present river at Hertford, that the New River would be a sufficient channel in which to convey water to your reservoirs and without a cover?—The covering of our river would of course make the whole thing more perfect and if you had no regard to cost it would be advisable to do it, but I have made no estimate. I think that the cost of covering the New River from end to end would be a very considerable item in any estimate for new works.

3044. Are there any sources of pollution by which the New River is contaminated between Hertford and the reservoir?—None.

3045. Are any steps taken to prevent pollution getting in in any way?—Much of the channel of the New River is railed in. Where it passes through private property and garden grounds, railing cannot always be applied. There are banksmen in charge of the river from end to end, whose whole duty it is to go backwards and forwards to clear the stream of weeds and to prevent pollution of all kinds.

3046. Might we take the New River between Hertford and Ware, as we saw it, as exhibiting a fair sample of the condition of the New River throughout its entire length?—I think so. In some places the river is prettier and looks even neater than that.

3047. If you maintain the New River as an open channel to convey the water to the reservoirs, would not the expense of collecting the water from your springs and supplying the New River with pure spring water be comparatively small?—The chief difficulty with regard to the collection of water above Hertford I think would arise from the nature of the ground in which the reservoirs would have to be made; the porous nature of the ground and the collection of the water there might be a matter of difficulty. It may be known to the Commissioners that the late Mr. Rendel, in conjunction with Mr. Beardmore, proposed certain reservoirs to be made; one on the River Lee, one on the River Ash, and a third one was to be made on the River Rib. The scheme was abandoned, but Mr. Rendel seemed to think that it was feasible to make reservoirs there. I cannot myself overlook the difficulty of making reservoirs sufficiently water-tight in such a geological formation as we have above Hertford.

3048. Do you think that if dams were run across the valley as proposed, the water would escape by some other outlet?—I fear that. You have heard from Mr. Beardmore how porous the soil is, which is an advantage in some respects, but that advantage would be a disadvantage in my opinion when you came to construct reservoirs upon it. It would make the construction most costly, because so much puddle would be required.

3049. You mentioned the other day, or Mr. Beardmore did, that there were a great nnmber of springs issuing below Ware, between Ware and Waltham Abbey?—There are a great many. Mr. Beardmore's own gaugings and Mr. Simpson's gaugings have shown that the river is receiving an accession in its own bed from some unseen channels, and that the volume of water is increased considerably after it leaves the Ware tumbling bay.

3050. Do you think it is possible for the East London Waterworks Company to obtain their supply from those springs without taking any of the polluted water of the River Lee?—My idea is this, that if you succeeded in cleansing the river of the sewage coming from the places which have been named, it would be of little consequence where the reservoirs were made. If the reservoirs were made lower down the valley, where the nature of the soil would make their construction comparatively easy, and where also you could collect a much larger volume of water, there would be no difficulty in supplying with good water the East London Water Company, as well as adding to the quantity of water the New River Company might take.

3051. You mean after they have reached the London clay?—Yes.

3052. Where there would be no leakage?—Yes.

3053. That would be below the junction of the River Stort, would it not?—Yes. The clay I think comes into the valley above the junction with the Stort, but to obtain the advantage of the Stort water for the East London Company, some of the reservoirs would need to be below that junction.

3054. (*Chairman.*) Do you know anything of that report (*handing the same to the witness*)?—Yes, I have read it.

3055. Were you engineer when it was made?—No, but I was in the New River Company's service. I was not chief engineer, I was Mr. Mylne's assistant at that time.

3056. Perhaps you will be kind enough to look over the description contained in that report of your works as far as it goes, and add to it any further information which you may have collected?—I shall be happy to do so, although I may state that at the beginning of this year a return was made to the Board of Health, which would, I think, in every way answer your purpose, showing how far we have extended the works since that report was made.

3057. Did you draw up that return?—Yes.

3058. Then you speak from personal knowledge of it?—Yes.

3059. Was that return sent in direct to the Local Government Act Office, and at what date?—It was sent in to the office of the Board of Health, I think, in May last.

3060. Was it sent in in compliance with a requisition, or in the ordinary course?—In compliance with a requisition from them.

3061. (*Mr. Harrison.*) In the return you have handed in there are many complaints of want of water where there are additional cisterns; have you a record of all the cisterns to which you supply water?—No. I explained before that the time of the service during which the water is left on to fill the cisterns is always made sufficient to fill the largest cistern on that line of pipe. If, without our knowledge, a cistern has been increased in size very much, the time of the service may be found insufficient, and we do not know of it until a case of this kind occurs, and then we take measures to increase the time of the service to fill it up.

3062. There appear to have been three complaints in the course of the year of the leakage of gas into the water?—Yes.

3063. What is the effect of that leakage when it occurs?—I may first explain that it arises generally from some heavy leakage in the gas pipe near to the water pipe, and when the water is shut off from the service the water drains into the lower cisterns of the houses, tending to cause a vacuum in the last-named pipe. This vacuum is supplied by gas, found in the ground round it, if the water-pipe is defective.

3064. When you shut off the water from a certain district during 24 hours do you find that the pipes in that district have filled in the meantime to any extent with air?—Very often.

3065. How does it get into the pipes?—I suppose it is chiefly drawn into the pipes through the tenants' lead pipes.

3066. Does it collect in your mains?—Not in the mains, because the mains are what we term always charged, and the branch pipes (that run from the mains from which the tenants' communication pipes get water) only are shut off: and those branch

pipes are liable to an accumulation of air to some extent.

3067. Are these branch pipes large ones?—They are generally three and four inches in diameter.

3068. Do you find that the air accumulates in them?—Yes, when they are shut off.

3069. If there was a gas pipe leaking in the neighbourhood, would not the gas be apt to get into those pipes instead of atmospheric air?—Yes, and it does get into them, when there is leakage also in that branch water pipe. The kind of complaint you refer to generally arises when there is a leakage in the gas-pipe and when there is a leakage in the water-pipe near it.

3070. That is a kind of complaint that would not arise if the system of supply were a constant one?—It would not. It must be borne in mind that the cases are very few in which such a thing occurs.

3071. (*Chairman.*) Have you ever considered this point when you are drawing off the water intermittently, whether it would be difficult to invent a reversing valve that should fill the main so as to prevent it sucking from any foreign source?—I have done so in some cases by little valves but they are very apt to get out of order. I tried them as an experiment only.

3072. It must be a valve of considerable size?—No doubt larger valves would answer better.

3073. Supposing you had a flat disc 12 inches in diameter that would drop a quarter of an inch, and that was connected with a six-inch pipe, the moment the water rose, that disc being so much larger than the pipe, the pressure underneath would close it?—Yes.

3074. Being so much larger than the pipe, when you drew the water away the pressure of the air on the top would open it; that is to say, by making the disc larger than the pipe you would make it self-acting?—Yes, I quite see what you mean.

3075. Would it be possible to make such balance valves and place them where you would be absolutely certain that you would fill your mains and not force impurities into the pipe?—It would be quite possible if we had one of those valves on every one of our 5,000 services; but it would, I am afraid, be rather a troublesome addition to our apparatus.

3076. How many sections have you divided your works into? I do not imagine that such a valve would be required upon every service, but upon every section of services?—It is only in the service pipes that this gas accumulates.

3077. Not in any of the branch mains?—No. If the thing was to be carried out completely, it would require one of those valves in each of the 5,000 services that we have, and it would be only to meet the few cases of complaint that we have had made.

3078. (*Mr. Harrison.*) There have been 182 complaints of short supply from defects in ballcock, lead pipe, or other apparatus belonging to the tenants, but those would be complaints for which I suppose you are not liable?—Not at all, a great number of the complaints will be found to be of that kind when they are investigated.

3079. Complaints arising from neglect on the part of the tenants themselves or the owners of the property?—Yes.

3080. (*Chairman.*) Your supply being intermittent, I presume you supply the service tanks and service tubs which are placed in the back yards and front areas, and in fact almost every conceivable place contiguous to the houses?—We do. There is a great deal of waste in the New River district, as in others, and our attention is constantly directed to that; it requires quite a staff of men to visit continually in order to keep that tendency down in places within control.

3081. Do you know that servants almost as a rule either prop up the ballcock or take it bodily off, so that there may be no stoppage to the incoming of the water when it is on?—Yes.

3082. And supply, in that case, means a supply of waste?—Yes, we know that half the quantity would probably suffice for use.

3082a. That is, for all reasonable use?—Yes.

3083. (*Mr. Harrison.*) You mentioned the other day what you considered to be a fair sized cistern for the ordinary tenements of the poorer classes?—Yes, I said that I had gauged a certain class of houses called model lodging houses, specially to be used for the habitations of the poor, and in those houses the consumption did not reach seven gallons per head per day, allowing them to take all they required.

3084. (*Chairman.*) Had they a constant service?—It was not a constant service, but the enlarged cisterns were filled daily; they were never empty, so that it was constant to them.

3085. If you had to supply a block of property with 1,000 persons in one court or range of courts, it would not, I suppose, require a very large cistern to supply 1,000 inhabitants?—No, it would not.

3086. Do you think that if London were divided into sections, and were so supplied with water, you could reduce the volume of water that is now wasted to a very large extent?—Very much indeed, and the supply would be constant to the whole. The only objection that I ever heard against the plan is that of having cisterns at all. Some persons exclaim against cisterns as being something wrong, but if they are made of cast iron or slate and are covered and properly placed, so as not to be fouled either by dust or infiltration, I think no mode of supply is better.

3087. (*Mr. Harrison.*) If cisterns were made such as the Chairman suggested, those large cisterns might be placed under the control of the water company, might they not, and with advantage?—We are allowed now so far to control the cisterns and the fittings as to require imperfect ones to be made good, but we find that the amount of power we have is not sufficient to make sure that the cisterns are sufficiently well covered and that proper apparatus is provided by the landlords.

3088. If cisterns were provided to supply 1,000 houses, could not the water company then overlook them and see that they were properly attended to?—To have one large cistern to overlook for the supply of a large number of houses would of course be easier than having one little cistern in every house.

3089. If such a plan was adopted, do you think that the water company could keep the cisterns in an unobjectionable state?—Yes, by cleansing them; at the present time we do not undertake to cleanse them, and it would be an additional duty laid upon the company if we had to cleanse any cisterns.

3090. (*Chairman.*) If the water is clean when passed into the mains, and it is not allowed to see daylight till it comes into a properly arranged cistern, is there any probability that it will get foul?—I think not, if the cistern is only properly placed.

3091. And protected from external impurities?—Yes; I believe that the thing it would suffer most from would be vitiated air coming into contact with the water, and the water absorbing it.

3092. If the cistern were covered and ventilated, do you not think that you could dictate what kind of air should go in, as every particle might be made to pass through a charcoal filter?—We could do that.

3093. (*Professor Way.*) So that when the air went in and out, when the cistern was filled, it would be pure air that went in?—It might be drawn through a charcoal sieve.

3094. (*Chairman.*) Do you know that pure water, that is to say, water which so far as we know has no impurity in it, if placed in a covered reservoir absolutely requires ventilation to keep it sweet?—Yes; I believe that the purer the water the more rapidly it gets contaminated.

3095. (*Mr. Harrison.*) You mentioned seven gallons per head as the quantity taken in the case of the model lodging houses, but 30 gallons per head is the actual quantity consumed over the whole district?—Yes.

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3096. You stated that you had very much diminished the leakage throughout your district; if so, what becomes of that large difference?—It is wasted through having defective ballcocks.

3097. (*Chairman.*) Or defective services which have no ballcocks, where they have been deliberately taken off?—Yes.

3098. Is there anything further which you wish to bring before the notice of the Commissioners?—I was asked at the last examination touching the limits or limit of the company's supply. I mentioned then 35,000,000 of gallons per day as the limit, but I wish it to be understood that that is the limit with the existing works, because it is already in evidence that the New River Company have a right to a moiety of all the water of the Lee. At present, we use only between 18,000,000 and 19,000,000 of gallons per day on the average; the average quantity for the past portion of the present year has been very little over 18,000,000 of gallons.

3099. What would be your limit if you went to the utmost extreme, knowing all the sources that you have to draw from?—All the flood water of the Lee, not yet touched, could be made available for the two companies after the purification of the valleys which you have now in hand. The exact addition that it would make to our resources I cannot say. It would require more careful gaugings than I have made to ascertain that.

3100. That flood water would be economised, and held in storage reservoirs?—Yes. The New River Company, moreover, have an old right which has not been exercised for many years, but it is in their power to deliver water into the streets of London, for sewer purposes and sewer flushing, for surface cleansing and similar uses (for which filtered water is now wasted) by pumping from the Thames between Blackfriars Bridge and Southwark Bridge. We have now a suction in the Thames, which has not been used for many years, and by carrying out separate lines of mains a very sufficient supply of water for the above purposes may be obtained in the New River district from the Thames.

3101. For surface washing and surface watering?—Yes, and it would practically add a good deal to the company's resources.

3102. Looking to the supply of water as it exists in London and the population of London as it at present exists, what are your views, as an engineer having charge of one of the greatest sources of supply, with respect to an entirely new supply for so great a population as that of London?—I cannot think that an entirely new supply is yet needed. If you look into the very far future, there is no saying what may be required, but if the Thames is to be thoroughly purified, and the valleys of the Lee are to be purified, and the water can be properly economised and distributed, it will provide a fair and abundant supply to the inhabitants of London for many years to come.

3103. If you replaced a moiety of all the water that is supplied to London, that quantity, utilized as it might be, would supply the wants of a population of 6,000,000?—Without bringing in an additional drop of water, that saving would provide London with water for 50 years to come.

3104. Is there anything further you wish to add?—I should wish to state what payments the New River Company have already made for the improvement of the River Lee. Some of the payments were for navigation purposes, other outlays have been for the purification of the Lee. I have here the amounts more accurately set down, and I believe that the sums which the company have paid for the improvement of the navigation may be put down at upwards of 53,000*l.*

3105. Within what period of time?—The payments before 1855 appear to have been but few and small, but in 1855 the sum expended was 42,000*l.* for navigation purposes. The New River Company have lately re-erected one of the locks on the navigation at Hertford, and altogether their outlay for navigation purposes has been 53,000*l.* up to the present date It has been 47,400*l.* since 1855, and there were other small amounts before 1855.

3106. (*Professor Way.*) It has not been for the improvement of the water supply, has it?—Indirectly it has. It has been like sums of money to be laid out on the River Thames in improving the navigation of the whole course of the River Thames, and water companies are supposed to benefit by those improvements.

3107. (*Mr. Harrison.*) It has been stated that the water which the New River Company abstracted from the river at Hertford lowered the water to such a degree that the boats could not pass over the sill into the lock?—Yes.

3108. And therefore the company went to the expense of constructing a new lock, so as to improve the navigation and enable you to continue to take the same quantity of water?—Exactly so.

3109. (*Professor Way.*) That did not improve the water, but it enabled you to take more?—It did not affect the quality of the water, but I may say that other outlays which the company have made have had to do with the quality of the water, and they have spent more than 30,000*l.* on sewage works connected with the River Lee.

3110. Do you mean at Luton?—No, at Hertford. The town was sewered and works were erected, the working cost of which exceeds 600*l.* per annum, so that if you take the interest upon the first cost of the sewerage works, rather more than 1,500*l.*, and add to that the annual outlay for carrying on the works, the total is 2,132*l.* annually paid for sewerage works, without at all saying whether the money has been judiciously spent or not. The New River Company pay to the River Lee trustees annually 1,500*l.*

3111. (*Chairman.*) Looking at what you have had to do to make your own supply available, and at what you have to pay annually for the purification of the sewage, do you think that the West End companies are hardly dealt by in having to pay 1,000*l.* a year to the Thames Commissioners for what they are to do for them?—I think that we already pay more in proportion.

3112. (*Professor Way.*) Are you under any engagement with the town of Hertford for the purification of the sewage for any number of years?—No; I suppose it is to be perpetual.

3113. Supposing that you desired to apply the sewage of Hertford to the land instead of precipitating it, would it be feasible to do so?—I believe it would be quite feasible.

3114. Who do you think would have to move in it?—The Act of Parliament does not contemplate such a way of disposing of the sewage. It states that it is to be deodorized, and if a certain process—say the process of distributing it over the land—is proved to be the best plan, I think it would come within the terms of the Act to apply it to the and.

3115. Have you any other evidence to lay before the Commission?—Nothing else occurs to me at present except to give you this account (*handing in the same*), and the titles of the Acts of Parliament to which I have referred.

1. Chapter 160. An Act to enable the Governor and Company of the New River to improve their supply of water, and for other purposes, dated 30th June 1852.

2. Chapter 39. An Act to enable the New River Company to construct certain sewers, drains, and other works in and near the town of Hertford, and for other purposes, dated 2nd June 1854.

3. Chapter 42. An Act to enable the New River Company to raise a further sum of money, to construct other sewers at Hertford, and to amend the Acts relating to the company, dated 13th July 1857.

The witness withdrew.

The witness subsequently forwarded to the Commissioners the following paper:—

STATEMENT OF THE CHANGES AND EXTENSIONS WHICH THE NEW RIVER COMPANY'S WORKS, &c., HAVE HAD SINCE REPORT THEREON BY SUPERINTENDING INSPECTORS OF THE GENERAL BOARD OF HEALTH IN THE YEAR 1856.

Acts of Parliament.

Since 1856, the New River Company have had authority (by their Act of 1857) to create a debenture stock in lieu of bond debt, to construct additional sewers at Hertford for the maintenance of the purity of the River Lee, and to raise a further sum of 300,000*l.* for the execution of these works, and for the general purposes of their undertaking.

The company are now seeking authority from Parliament to obtain the additional amount of 500,000*l.* for the increase, improvement, and extension of their supplies.

Sources of Supply.

The New River Company have, for their sources of supply (as in 1856)—

The Chadwell Spring,
The River Lee,
Amwell Well,
Amwell Hill Well,
Cheshunt Well,
Hampstead Road Well, and
Tributaries to the New River.

Also the following sources of which the company have possessed themselves since 1856:—

The springs at Hampstead and Ken Wood, the waters of which are collected in 13 ponds on Hampstead Heath and at Highgate, having a joint area of about 30 acres.

These waters are distributed by *separate* mains for *street*, *sewer*, and other *non-domestic* uses.

An artesian well on Hampstead Heath, formerly (with the springs and ponds above named) the property of the Waterworks Company, the supply of whose district was undertaken by the New River Company in the year 1857.

A new artesian well, recently made by the side of the New River at Hoddesdon, in Hertfordshire.

The last-mentioned well has, as yet, done no work; and there has been no occasion for any use of the Amwell, Hampstead Road, and Hampstead Heath wells, for several years. They have been kept in reserve.

From all the above-mentioned sources (reckoning contribution from the Lee at only 2,500 cubic feet per minute) there may be obtained a daily supply of more than 35,000,000 gallons.

Although no supply has been taken from the Thames into the New River District, for any purpose, for many years, additional quantities of water may be drawn by the New River Company from that river, below *Blackfriars Bridge*, and delivered through *separate* mains to any extent that may be hereafter required, for *street cleansing*, *sewer flushing*, *extinction of fire*, and other such uses.

In order to add to the provisions which they have already made, for the future, the company have purchased nearly 90 acres of land for the construction of a store reservoir near Broxbourne, are increasing their means of supply from Amwell well; and are making arrangements for the sinking of a new well on the line of their river between Hoddesdon and Cheshunt.

The company's draught from the River Lee is not limited to the 2,500 cubic feet referred to above, and named in the report of Inspectors to the Board of Health in 1856. The said quantity (equal to 22,435,000 gallons per day) represents only the rate of draught to which the New River Company have a prior right. For by pumping to supply the demands of the Lee navigation, and by provision of steam power for mill owners, the New River Company, in conjunction with the East London Waterworks Company, may take the water which those two objects would otherwise absorb, and may, by storage, also make use of the flood waters of the Lee to any extent that may be necessary.

Since 1856, the New River Company have constructed sewers throughout the town of Hertford, and have erected works at which the sewage of that town is dealt with, and disposed of, as the New River Company's (Hertford Sewage Diversion) Act of 1854 directs.

The shortenings and improvements of the channel of the New River (effected before 1856 as far down at Cheshunt) have been subsequently continued, and completed between Cheshunt and London. And so much of the river channel, as is within the more urban parts of the metropolis, has been covered over for the better protection of that part of the company's supply which is delivered for filtration at the New River Head.

Reservoirs.

The small circular basin which was situated in the Hampstead Road, and reported in 1856 as then used only for the supply of contiguous baths and wash-houses, has been removed, the establishment which it served having been closed. This excepted, the company now have, in addition to the reservoirs named in the report of 1856, and in addition to the above-mentioned 13 ponds at Hampstead and Highgate, a new subsiding reservoir at Hornsey, with an area of 8 acres, and a capacity of about 20,000,000 gallons; also covered, filtered-water, service reservoirs on Highgate Hill and Hampstead Heath, having a joint area of 22,000 square feet, and a joint capacity of about 1,500,000 gallons.

The company's store and subsiding reservoirs now have a total area of about 100 acres, and a total capacity of about 200,000,000 gallons. Their covered, filtered-water, service reservoirs, have a total area of about 164,000 square feet, and a total capacity of about 20,000,000 gallons.

Filtration.

The means of filtration which the company had in 1856, have been increased by the provision, at Hornsey, of three new filtering beds, having a joint area of two acres. Contracts have been entered into for the construction, at the Company's Stoke Newington Station, of two other beds of the united area of two acres.

When these two beds are finished, the company's whole filtering area will be equal to 11½ acres.

The result of the company's filtration is seen in the analyses, which they regularly obtain, of the water of the New River, as the same is delivered to consumers in their district:—

The average amount of organic matter which *twenty-four* of these analyses (made by Dr. Letheby during the past year) assigned to one gallon of water in decimal parts of a grain, was	0·454
Some of the examples examined had but	0·2 or ⅕th
of a grain of organic matter in a gallon, that is one part in 350,000 parts.	
Eleven analyses obtained and published for the same period by the Registrar General, gave an average of	0·671
parts of a grain per gallon, as the amount which New River water contained of organic ingredient, hygrometric moisture, and whatever else was driven off by incineration.	
Analyses published under the same authority, have shown the organic impurity of—	
Loch Katrine water in parts of a grain per gallon to be	0·605
And of *Manchester* water, according to the same scale, to be	0·680

Pumping Arrangements.

Since 1856 the New River Company have erected an engine of 75 horse-power (with three boilers) at Hornsey, and an additional engine of 30 horse-power, with extra boiler, at Highgate, to aid in the "second lift," by which water is raised to the top of Highgate Hill and Hampstead.

They have also placed a 50 horse-power engine and boiler at their new well at Hoddesdon.

Their whole engine power is now that of 1,680 horses.

Tenements supplied.

The New River Company now supply water to 111,958 houses.

Rates of Charge.

These are regulated by the New River Company's Act of 1852 (sections 35 to 41 inclusive).

This Act makes a supply of water for domestic use, in the New River District, to be generally liable to a charge of 4 per cent. per annum on the annual value of the houses served with certain extra rates for baths, high service, and waterclosets, in houses having a higher annual value than 30*l.*

In many cases charges remain considerably below the limits at which they might, by the said Act, be fixed.

All supply of water for extinction of fire is *without charge*.

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Mode of Supply.

The New River Company's supply continues to be, in most cases, an "intermittent one," delivered into the tanks, or butts, which consumers provide. And wherever there is sufficient cisternage, properly placed, protected, and cared for, consumers have no inconvenience from the arrangement. They then, on the contrary, have, what is practically, a *more constant* kind of service than that which would be furnished by the mere connexion with a "main" which is often described as "constant supply." With this so-called "constant supply," without cisterns houses must be entirely without water on every occasion on which mains have to be closed for their unavoidable extension or repair.

Supplies, intermittently furnished by the New River Company, are "turned on" daily, for, at least, six days a week; and are "left on," on each occasion of delivery, for as long a time as may be necessary (with adequate house pipes) for the filling of any reasonable amount of cisternage which consumers may provide. In some cases of intermittent service, in which the supply of the poor is concerned, and in which parish authorities remain unable, after their best exertions, to compel the landlords of small houses to provide properly for their tenants' reception of water, a seventh or Sunday supply, is given. About 4,000* houses in the New River District now have such extra service. Sunday supply is, of course, also afforded to all houses "on the main." The company have more water to pump on other days of the week because of non-delivery of it on Sundays. They also pay their foremen, turncocks, and engine-workers for Sundays, as if they all then worked; but their rule is not to deprive these men of their Sunday's rest without good cause. And in few cases can it be truly said that the turncock's services on Sunday are necessary. Often where the want of them is complained of as an evil, the loss of water by leakage, through the consumer's faulty cistern fittings, is the sole cause of the inconvenience felt.

Wherever consumers are ready to take water in any way that will give a sufficient guarantee against *waste*, the company are ready to make supply "constant" in the sense of allowing an uninterrupted communication with their mains. They do so now in more than 1,200 cases. The general adoption of the "constant system" would be for the company's advantage, if only it could be effected without waste. The company, therefore, have no interest in the discouragement of *that* system under any conditions which would effectually prevent waste. *Without the strictest precautions against waste*, the "constant system" would greatly increase the company's filtering, pumping, and other expenses, and would through these expenses alone, operate not a little—although indirectly—to the disadvantage of the public. A wasteful, constant supply, would bring this further injury to consumers, that in consequence of the excessive discharge which it would allow in the lower levels of a district, it would leave houses, in the higher ground of the same district, far short of their fair share of supply.

Thus special provisions against waste are the indispensable accompaniments of any attempt to afford constant supply. Such provisions, however, involve both a *cost* in the alteration of house pipes, &c., and *restrictions* to which consumers in London are not ready to submit. Hence it is that there is yet but a *partial* adoption of "constant" service in the New River District, although the New River Company have been perfectly prepared for years to furnish it, on the fulfilment, by tenants, of the conditions which the 15th section of the Metropolis Water Act of 1852 prescribes.

In no case has there been requisition to the company, under this section, to provide the constant supply to which it refers.

"*Constant supply*" is sometimes spoken of as if it were the only *high pressure* one. But the "*intermittent*" supplies which the New River Company give *are of high pressure.*

Although so many houses in the company's district continue to be "*intermittently*" served, all the company's leading pipes, or "mains" (having an aggregate length of more than 200 miles) are "*constantly*" charged, so that by the mere drawing of a plug on any of these mains, there may be instant supply for the extinction of fire; and by the opening of a single cock, there may be immediately charged, for like service, any one of those short, subsidiary, lines of pipe which are branched from these leading mains, and which lie in every street in the company's district. Here are better means of concentrating pressure for water supply at fires than there would be with all pipes charged (as under the "constant" system) and open at all times to the draught which the service of consumers, or their waste, might cause.

Under existing arrangements it is very seldom that water from the company's pipes is not flowing *before* the engines of the fire brigade are ready at a fire to use it. If fire engines have had, at any time, to wait for water, it has been through delay in the call of a turncock to the spot. To induce the early call of their turncocks, and to insure the quickest attention thereto, the company reward all persons who first give notice of fires; they allow their own men gratuities for promptness, they set up marks to indicate the places at which their turncocks and deputy turncocks reside, and they forward, every quarter, to all *police, fire, parish*, and other public stations, printed lists of the names and addresses of their street foremen, turncocks, and deputy turncocks, with advertisement of the reward which they pay (as aforesaid) for "first calls." To meet the rare occurrence of a turncock's late call, the company have repeatedly intimated their readiness to allow both firemen and police the use of the keys, by which these officers might, at any time, in the absence of turncocks, obtain themselves the water wanted at a fire. The firemen have, in fact, such keys, but decline the responsibility of using them. By the attachment of improved hydrants to mains, these might be some additional facility for the ready acquirement of water for extinguishing fire, but such new appliances would throw on parishes considerable additional outlay.

What Parish Authorities have done to require a Supply of Water to the Houses of the Poor, under the 27th section of the Metropolis Water Act of 1852.

Parish officers have exerted themselves, on many occasions, within the New River District, to require the owners of small houses to procure a proper water supply for their tenants; and in so doing, they have had all the aid which the company are able, in such circumstances, to render.

No formal requisition, in regard to a reduction of charge, has, in such cases, been made to the company by churchwardens, or other parish authority, under the 27th section of the Metropolis Water Act of 1852; but the company have always willingly laid down pipes, when these have been needed, to bring water within the reach of the poor; and they have been careful to apply only *reduced* rates of charge for the water supplied to any house property of the humbler sort.

Quality and Quantity of Water supplied.

In regard to the *quality* of the water served by the New River Company, it will here suffice to refer to analyses already published, and to the previous statements under the head of "filtration."

As to *quantity*, the company are always ready to serve as much water as the consumption of their district requires. The average daily demand of 111,447 houses during the past year was 23,460,548 gallons.

The company have no knowledge of any complaint by memorial to the Board of Trade, under the 9th section of the Metropolis Water Act, with regard either to the *quality*, or the *quantity* of their supply; and they have not had either inquiry or notice on such subject from any inspector appointed by the said Board, under the 10th and 12th sections of the above-named Act.

There are, no doubt, within the company's district, many cases of very imperfect supply, especially to houses in the occupation of very poor people; but for the defects of these cases the company are in no way responsible. The company have laid down the pipes which could furnish a good supply; they have, in certain cases, offered, for moderate interest on their outlay, to provide the apparatus by which landlords ought themselves to secure for their poor tenants a proper water service, and they are ready, with any provision which landlords may make for the reception of supply, without waste, to let the service of the houses in question be a "constant" one. Whatever defects remain are due to the indifference of landlords, and their inadequate arrangement for the water supply of their tenants.

Cost of the Company's Works.

The report of the Inspectors of the Board of Health in 1856, represented the New River Company's whole outlay on works, up to the end of the preceding year, as 1,987,801*l.*

The company, at the close of the past year, had laid out on new works and extensions, inclusive of purchase of lands, &c., the further sum of 508,756*l.* 17*s.* 7*d.*, making, with their previous outlay, a total expenditure of 2,496,557*l.* 17*s.* 7*d.*

(Signed) JAMES MUIR.

* This number has been raised, since the date of the above return, to nearly 50,000.

Mr. JAMES KNIGHT examined.

3116. (*Chairman.*) What are you?—I am surveyor to the vestry of Mile End Old Town.

3117. Was the report which is lying on the table made by you to that vestry?—It was.

3118. Do you wish to put it in?—If you please (*handing in the same*).

3119. Does that report contain an account of a personal inspection made by you of the New River?—Yes, and of the river Lee, and the river Stort.

3120. I see that you have given the details here with regard to these rivers, and you end with a summary. You say in this summary that "the water "of the East London Waterworks Company is pol- "luted to a very large degree by the drainage of the "towns and villages situate on the banks of the river "Lee, from whence they derive their supply." You speak, I suppose, from personal inspection?—I do.

3121. Then you say that "an abundant quantity "of water, of even flow, and of the character at "present supplied, is not to be obtained in the sum- "mer without storing it for several months in open "ponds." Where are those open ponds situate?—They are reservoirs which have been recently constructed at Tottenham.

3122. What volume of water do they contain?—I do not know the actual quantity; but the average is something like 80 acres. 110 acres of land altogether would include the whole.

3123. Then you say lastly, that "pure water in "sufficient quantity for the present and probable "future wants of the district cannot be obtained in "my judgment from the present source of supply at "all"?—I do.

3124. Do you know what is the volume of water that they profess to give daily to the metropolitan population that they supply?—About 24,000,000 of gallons.

3125. What would that be per head of the population that they deal with?—Nearly 30 gallons per head.

3126. From your experience, do you believe that 30 gallons per head are recognized or used?—The 30 gallons include the whole of the water supply for every purpose. It is not alone for the consumption of human beings.

3127. Do you know what proportion of that quantity would be consumed for trade purposes?—No, but I know that it is large.

3128. Do not you know what proportion is used for domestic purposes?—I cannot say.

3129. Have you ever made any experiment as to what any number of persons or any family would use if they did not waste any?—I have.

3130. What volume should you say would be used?—For all purposes, taking the period of a month, about 11 gallons a day per head.

3131. If the same persons or families were simply to use water and not waste it, you think that 11 gallons a head would be enough?—Yes, I do.

3132. Can you detail to us how you tested that?—By management, in a cistern in one of my own houses.

3133. Did you adopt some mode of registration?—Yes, from morning to morning—it is an intermittent supply—I gauged the quantity which had been delivered into the cistern.

3134. In your own house?—Yes, in a house that I own.

3135. Do you consider that you made your experiment with sufficient care, so that it may be taken as a reliable experiment?—I do.

3136. Do you consider that the supply is ample for all their requirements?—Yes, they always have water.

3137. Were there any parties in the house to which you have alluded who were accustomed to take a morning bath?—No, it was comparatively a poor house.

3138. For bath purposes the volume must be added to?—Yes.

3139. Mile End Road does not, I believe, come into the New River district?—No; it is in the East London district. The whole of Mile End is, and Whitechapel, St. George's-in-the-East, Limehouse, Poplar, Bethnal Green, Hackney, and part of Shoreditch. I speak of the water supplied to the East London district.

3140. At what date did you make your investigation?—September 18th, 1866, and other days.

3141. How many days did it occupy you?—Five.

3142. Were you at all acquainted with the river and the sources of water supply before making that investigation?—I knew something of it. I had been over the ground previously.

3143. You did not then know it so intimately as you do now?—No.

3144. In making your inspection did you find the sources of pollution more injurious or less than you had anticipated?—Infinitely greater.

3145. You found that the pollutions were larger than you had anticipated?—Very much so.

3146. Did any person accompany you when you made the inspection?—No official.

3147. Did you communicate at all with the authorities of the river Lee or the New River Company previously to making the inspection?—I did not.

3148. Did your board send a copy of your report to the East London Waterworks Company?—Yes.

3149. Did the board receive any reply after their reception of it?—I am not aware that they did.

3150. Are you aware whether any part of your statement made in this report has been disputed?—I am not aware that any part of it has. I attended a deputation of the vestries and district boards of Whitechapel, St. George's-in-the-East, Limehouse, Poplar, Hackney, Shoreditch, Bethnal Green, and Mile End—altogether eight—which waited upon the East London Water Company.

3151. What took place at that interview?—We met the board of directors, and requested to know whether they proposed to make any alteration in the quality of their water, and we were informed that they intended to go to Parliament this session for power to take water from the river Thames, in addition to that which they have from the Lee. They also told us that they intended to ask for power to compel the various towns in the Lee valley to prevent their sewage from contaminating the water; but they did not propose to go to any expense in the latter case themselves.

3152. Do you know whether they have taken steps to fulfil their promise to you?—Yes, they have, so far as the advertisement of their intention goes.

3153. Previously to your making this investigation as to the water supply, had you made any personal examination into the seats of cholera in the several areas that you have enumerated?—Only within our own district.

3154. Which is that?—Mile End.

3155. At which points did you make your investigation?—I will point them out on the map (*describing*).

3156. Whereabout did the cholera rage the worst during the last spring and summer?—In our own district it was nearly equally distributed over the whole area.

3157. Where had it first commenced?—It first commenced at the eastern end of the district, at the south-eastern corner—Stepney.

3158. What road is that (*pointing to the map*)?—The Mile End Road.

3159. Did it commence at the corner formed by the crossing of the Mile End Road and the Regent's Canal?—No, it was at our eastern boundary, near to Bow, that is where it commenced.

3160. At about what date did it first break out?—I think it was on the 13th July; it began at West Ham, and passed the next day into Bow; the following day it visited us at Mile End.

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3161. Did you about that time have any complaints made to you as to the quality of the water supplied to the inhabitants?—None.

3162. From your own knowledge have you reason to believe that the East London Water Company had been supplying a different kind of water from that which had been ordinarily pumped into the district?—I have strong reason to suspect it now from what I have seen.

3163. From what source do you think that water was obtained which you believe was different from the water usually supplied?—From Bow Creek, or that part of it which is now navigation, immediately below King's lock.

3164. Have you any reason to know why that water should have been drawn upon at that time?—There was a broken main which passed under the old river, and which had been known to the company to have been damaged, as I am told, for 18 months.

3165. Did that broken main interfere with their getting the filtered water which they usually supplied?—The filtered water passed through that main and the main passing under the old river, and being cracked, the water from the river, which at high tide is driven up over a little penstock, was really mixing with the water of Bow Creek.

3166. Then you have reason to believe that the main supply pipe laid down under the old river, from some accident, or wear and tear, or something else, had cracked, and to that degree that it was capable of admitting the foul water from the old river above it?—From the investigation that I made I was led to believe that it was the main pipe leading from Lee Bridge works to Old Ford works.

3167. If that main pipe drew water from that source, would that water be contaminated by the sewage of West Ham and the sewage of other districts flowing into the creek above and below that point?—Not by the sewage of West Ham, but the whole of the other districts.

3168. Why not by the sewage of West Ham?—Because that is turned into Bow Creek, a long way down, just at the tide's end.

3169. Then it would be by sewage from portions of the district situate above?—Yes. There are a number of factories on the banks of the river, and the water is always in the most foul and filthy state.

3170. Why do you think that contaminated water might have been pumped in from that source?—From the fact of the pipe being laid under contaminated water and having a fracture in it.

3171. Do you know at what time the fracture occurred?—I do not know, but I have been told that it was about 18 months since.

3172. And no steps had been taken to repair it?—They attempted once to do it, but not successfully.

3173. How did you obtain your information upon this subject?—There is a lockkeeper who lives on the spot, who communicated it to me through a friend.

3174. Is the lockkeeper a servant of the river Lee trustees?—He is; and he is quite prepared to give you this information; he was an eye witness to the whole; it was below the lock, and about half a mile above the crossing of the North London railway.

3175. Did the East London Water Company about that time take any steps to rectify that state of things?—They did.

3176. What were the means they resorted to?—By putting a jacket of lead round the pipe.

3177. Is that jacket of lead on the pipe now?—I believe it is.

3178. It is serving its purpose now?—I believe it is.

3179. (*Mr. Harrison.*) At what depth is it below the bed of the river?—A very short distance indeed, scarcely 18 inches; I mean the top of the pipe below the bed of the river. It was exposed when I was there.

3180. (*Chairman.*) Have you inspected the filter beds at the pumping station above, and the pure water basin, and the conduit below?—I have not recently done so, but I know them well.

3181. (*Mr. Harrison.*) Do you know what the level of the water in the reservoir is at Lee Bridge; is there a considerable lift to the level of the water in the covered reservoir at Old Ford?—I do not know.

3182. Be good enough to point out on this map where Blackwall is?—It is there (*pointing out the same*).

3183. Is that part of your district?—No, it is in the Poplar district.

3184. Is any part of your district below the high-water line?—No.

3185. Do you know whether a part of Poplar is or not below the high-water line?—A portion of it is below the high-water line.

3186. Do you know whether any part of that area was submerged by sewage in the spring and early part of this summer, in consequence of the flap valve getting out of order?—I do not know that; I have not heard it spoken of.

3187. Is the main sewer of the Metropolitan Board carried through your district?—No; it passes through Limehouse just below our district; Limehouse is next to the river, and the main sewer passes down below the Commercial Road.

3188. Are the old sewers from your district passed into the new sewer which has been constructed?—I do not think they are connected yet, but the work has progressed just up to the point for connexion; I do not think it is yet made.

3189. (*Chairman.*) Are there any private wells or pumps in your district?—Yes, several.

3190. Are there any, or many, privies with cesspools?—There are 800 in our district at the present time.

3191. Have you reason to believe that any of the cesspool matter can, by possibility, contaminate any of the wells from which water is drawn?—Yes, I have good reason to believe it, because this case occurred in Jubilee Street; there were six persons who died, I believe, of cholera there on its first outbreak, and we found upon inquiry that many of them had been taking and using the water from a yard belonging to a greengrocer who had died, and that water was from a surface well surrounded by cesspools.

3192. Can you give any other instance?—No other case which was so clear as that was.

3193. What is the subsoil in your district, is it gravel?—Yes, gravel on clay.

3194. Is it porous gravel?—Yes.

3195. What is the character of your sewers and drains, are they made of brick or pipes or both combined?—Lately all our main sewers have been made of brick, the smaller sewers are made with pipes.

3196. Are those pipe sewers so tight as to induce you to believe that the sewage cannot get out of them into the subsoil?—I cannot undertake to say that that is so.

3197. If there were any pumps near to any of your sewers or drains, might not the water be contaminated by them?—I think very likely it would be so.

3198. During the last spring or summer, after the cholera had broken out, was the necessity for taking means to close those pumps ever discussed?—Not until the cholera had broken out,

3199. Were any steps then taken to close them?—They made them incapable of use by taking away the handles and the buckets.

3200. Where they private pumps?—Yes.

3201. Were any remonstrances made by the owners?—Yes, but we disregarded them, and what we did was done at our own risk.

3202. Has the use of the pumps been restored?—Not at present.

3203. Are there any private wells at present in use?—Not to my knowledge.

3204. Have you taken any means to diminish the number of the cesspits or cesspools by serving notices

on the parties?—We are doing that very rapidly indeed.

3205. By whom are they cleansed at present?—By the owners of the property—the cesspits.

3206. Do they do it voluntarily, or have you to repeat the notices?—They have lately done it when they get foul.

3207. Are any of them so situated that the refuse has to be brought through the body of the house?—Yes, in almost every instance.

3208. During the time that that operation is going on, in what condition will the atmosphere be?—Very objectionable, indeed, very foul.

3209. Have you ever known sickness to be caused by the emptying of these foul places?—I have not.

3210. Have you ever heard of it?—I cannot say that I have. As soon as we discovered that there were so many cesspools still in existence, I received directions from the vestry to deodorize them all by using carbolic acid, which I did, and I have kept them flooded up to a recent day.

3211. What amount of disinfectants in point of value have you used this summer?—I think about 350*l.* worth.

3212. The vestry have voted that amount, and the disinfectants have been used at their expense?—Yes.

3213. Did you use the powder as well as the fluid?—We used the powder of the lime, and the fluid acid.

3214. Did you supply carbonate of lime to the poorer inhabitants for their own uses?—Very largely.

3215. Did you compulsorily limewash any of the filthy houses?—Yes, a large number.

3216. Did any beneficial results follow?—I cannot say.

3217. Did you examine the private waterbutts and cisterns to see whether they were clean or foul in any cases?—Yes.

3218. In what state did you find them?—Generally in a very filthy state caused by the individuals themselves neglecting their own sources of supply.

3219. Did you in any cases cause those receptacles to be cleansed?—In many cases we ran the water out, and had them scrubbed out.

3220. How do you suppose they had become foul?—Principally I think from children playing near them, and throwing filth in.

3221. What was the general character of the water supplied at the taps?—It had all the appearance of being pure.

3222. Was it usually bright or turbid?—It had a bright appearance.

3223. If it was bright and passed into a clean receptacle, I suppose it would be comparatively clean?—I think so, but from what I have seen of the contamination of the water, I should not be led to suppose that it was very good.

3224. From what you have seen since you have made this inspection?—Yes.

3225. Has that altered your opinion?—Yes, it has; I think it cannot be good water, being polluted to the extent that it is.

3226. Did you form any opinion as to whether it would be practicable to prevent that impurity?—I think there would be no difficulty at all if proper measures were carried out.

3227. Did you so report to your board?—No, I did not so report it to my board. I reported the facts without prescribing a remedy.

3228. Can you state what number of wells there are in the district?—I cannot tell. I do not remember that.

3229. You can perhaps obtain that information?—Yes. There are not so many now as there were some years ago.

3230. Has your vestry power to compel the owners of property by notice to put on a public supply of water?—Yes, under certain circumstances.

3231. Do they ever enforce it?—Yes, they do in some instances, but it has not been necessary in more than three or four.

3232. (*Mr. Harrison.*) Was the case that you alluded to of a death from cholera one of the early cases?—Yes. I think the greengrocer was almost the first person who died in our district.

3233. He and his family, as I understood you, were supplied with water from a well surrounded by cesspits?—Yes.

3234. The well was upon his own premises?—Yes. He had a water supply from the East London Water Company, but he had this well in addition.

3235. Did you ascertain whether the water from the well was used for drinking purposes, or whether the company's water was used for that purpose?—They assured me that they only used the water from the well for rough purposes, washing and things of that kind; but I found that the people in the district were in the habit of sending there to get a pail of water, thinking it was better than that which was supplied by the company.

3236. Do you think that many persons in that neighbourhood were supplied with water from that well?—I have no doubt of it.

3237. Were there many people in the immediate neighbourhood who suffered from cholera?—As I have already stated, there were six deaths, which took place within a very short distance, within 150 yards, of that place.

3238. (*Chairman.*) Knowing these facts as you do now, should you regard the East London Water Company as accountable for those deaths?—I do not; not for those. I think that, with other circumstances, which are inexplicable to me, the same thing might have arisen from bad water supplied from the East London Water Company, as from the bad water from this well, if it were so.

3239. Putting things honestly and fairly together, at the first outbreak of cholera, and taking the number of deaths which occurred, you think that you cannot attribute them fairly to the bad water supplied by the East London Water Company?—I do say so. These cases were not the first, but nearly the first which occurred. We had a death or two in the extreme eastern part of the district within a few days.

3240. Did the cholera in its course sweep through whole rows of houses, or step over intermediate places, and strike down here and there?—I found that it had been almost uniform over the whole district.

3241. Not visiting all the houses in one street, but one or two houses in a street?—Yes, in every street, visiting the poor and the rich alike.

3242. And one or two members of a family falling victims?—Yes.

3243. The cholera was rather sporadic than epidemic?—Yes.

3244. If you were to dot the map over with a pen with black spots, the district to which you refer would be pretty equally spotted over?—Yes.

3245. Did you notice whether the cholera was the worst in the very poorest district, or in the district more inhabited by the middle classes?—I do not think there was much difference. Some portions of the population were very poor indeed; but I do not think it affected them more than it did persons who had all the comforts of life about them.

3246. Did it affect the poorer classes as much?—I think it was as nearly equal as possible.

3247. It did not fulfil the conditions you would have anticipated by striking down the very poorest?—No, for in places where I should have looked for it to be the worst it did not appear till after it had affected a number of well-to-do people.

3248. Did you suffer at all from bowel complaint?—No.

3249. Did you take special care of your own health?—I think not.

3250. Were bowel complaints very general at that time?—Yes.

3251. Did any of your men suffer?—Only two.

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3252. What were they?—They were labourers on the road; old men.

3253. They might have been in a weak state of body?—They were, but they recovered.

3254. Were those men of sober habits, or otherwise?—They were tolerably temperate, I think, as ordinary working men. I should call them steady working men.

3255. Was your district as severely visited as Poplar?—No.

3256. (*Mr. Harrison.*) Stepney is close to your district, is it not?—There is no such place now as Stepney. Stepney now is divided into hamlets and parishes. Mile End is part of the old parish of Stepney.

3257. Is there not a registrar's district?—Yes, for Mile End.

3258. And another for Stepney?—There is another for the Limehouse division, Ratcliff, Wapping, and Shadwell. There may be one for the Stepney Union.

3259. (*Chairman.*) I believe the sewers and drains are not under your jurisdiction?—Yes, they are.

3260. It is the main sewerage that is under the Metropolitan Board?—Yes.

3261. Have you been carrying out much sewering and draining yourself in your parish?—Nearly the whole of our parish is now sewered. We have very little more to do.

3262. Are the sewers fully ventilated?—Yes.

3263. By open gratings at the surface?—Yes. I have tried charcoal, but I found that it did not effect the object.

3264. Do you cleanse the sewers by hand?—We do.

3265. What number of hands do you employ?—We have not sufficient employment for a regular staff at present. At the present time we have six men at work, but that will only last for, perhaps, a couple of weeks.

3266. Do you cleanse the sewers intermittently?—Yes; when it is necessary.

3267. Have you provided side entrances?—Yes.

3268. How many side entrances are there?—I think 23.

3269. What does it cost you, per cubic yard to get the refuse out of the sewer?—About 2*s.* 10*d.*

3270. How many cubic yards do you take out in a year?—The quantity is very little. The cleansing of the sewers altogether does not cost more than 80*l.* a year.

3271. What is the kind of material that is taken out?—Sand and gravel, which are washed in through the gullies.

3272. What is the shape of the main sewer?—They are all egg-shaped.

3273. Have you the means of flushing them by penstocks?—Yes, we have a few.

3274. Do you flush the sewers in that way?—Yes, we do.

3275. Do you think that your district will be benefited by the low level sewer that has been constructed?—Not in any way. We lie above it, and below the mid level sewer. Our district is drained now into the Thames.

3276. Will not that drainage be brought back into the low level sewer?—It will be so intercepted.

3277. Will not that be a benefit to you?—No, it will simply be passing the sewage into the low level sewer instead of into the Thames.

3278. Is it not tide locked now by being drained into the Thames?—Not in our district, we are above that.

3279. Into what district do you drain?—We drain through Limehouse in one portion, and from Ratcliff in another.

3280. Whereabouts on the Thames do your outlets discharge themselves?—There is one at Limehouse Hole, and the other is at Ratcliff.

3281. Are those outlets offensive at any time?—Very much so.

3282. Will they not be removed when the low level sewer is finished?—Yes.

3283. Your sewage will be taken in here (*pointing to the map*) and be pumped up at the Abbey Mills pumping station?—Yes.

3284. Are you troubled much with rats in your district?—Not in our sewers, I never saw such a thing.

3285. I suppose they cannot live in the egg-shaped sewers?—No.

3286. You know, I suppose, that in the flat bottomed metropolitan sewers there are plenty of rats?—Yes.

3287. Do you think that if yours had been made with flat bottoms you would have had the same trouble?—Yes. Ours are kept perfectly clean by their own action and the regular flushing that we give them.

3288. What is the least fall that you have in your mains?—The least fall that we have is 1 in 480.

3289. What is the greatest?—I think it is 1 in 240.

3290. Have you any difficulty in keeping them clean?—No.

3291. Have any complaints been made of a stench getting back into the houses that are connected with the drains?—We may have had one or two in the course of ten years, but I think not more.

3292. Do you ventilate by down spouts?—No.

3293. Are they connected with the tributary drains?—In nearly every instance.

3294. You could ventilate if they are connected without being prevented by trapping?—All our connexions are trapped.

3295. Do you bring the spouts down and connect them?—Yes, direct from the house to the sewer.

3296. Then the spout comes on to it?—Behind it, I may say.

3297. How many soil pans or waterclosets are there in your district?—The actual number is 12,000; there are 12,000 houses.

3298. What is the population?—80,000.

3299. Have you much trouble with them?—Very little. I know that in the poorer districts the landlords are annoyed by the tenants destroying the pans.

3300. In your opinion is it preferable to have waterclosets with the trouble connected with them, or to have cesspits with their abominations?—In my view there is no comparison, the watercloset is a remedy for the other, which is a horrible nuisance.

3301. Are you troubled with the waterclosets during a frost?—I never heard of anything of the sort; occasionally there has been such a thing in a very exposed place, but it is not general.

3302. Supposing the Manchester authorities told you that it was impossible to use waterclosets with a working population, what would you say to that?—My experience would lead me to the very contrary conclusion.

3303. And your experience has been upon a large scale?—Yes.

3304. Do you know the condition of the other parishes adjoining your district; have they waterclosets in the same proportion that you have?—Yes, they have, with the exception of Bethnal Green. I do not think they have got quite the same facility that we have, but the same system is being pursued as with us; they are going on.

3305. Are they abolishing cesspits and substituting waterclosets?—They are in all the adjoining districts.

3306. Are the vestry of your parish owners of all the dust?—Yes.

3307. Do you lease it to contractors?—Yes, and it will bring us this year 550*l.*

3308. If the dust was mixed with cesspit matter, would it bring you in as large an income?—We should have to use the whole of it and we should have to pay to get rid of it.

3309. Where a watercloset is used the dust is valuable, but if a cesspit is used the dust becomes of no value?—If we were to mix the soil and the dust together, then the two would have no value.

3310. But the dry dust is valuable?—Yes.

3311. It produces you 550*l.* a year?—Yes, and not only that, but we actually get 500*l.* for the concession.

3312. Which is an available sum, instead of having to levy a rate for that amount?—Yes; if we were to mix the dust with the soil, I think it would cost us 2,000*l.* a year to remove it.

3313. This arrangement is, in your opinion, an advantage to you to the extent of 2,500 a year?—Just so.

3314. (*Mr. Harrison.*) Have you abundant means of supplying the poorer parts of your districts with water?—I think it is very defective.

3415. How are the people generally supplied; what means are there of collecting water?—A kind of receptacle is used in the poor districts, but they are very poor things indeed, such as half a butter firkin very frequently, or a broken tub; cisterns, as a rule, are not to be seen—not proper cisterns in the poorer parts of the parish.

3316. Have you taken the trouble on any occasion to ascertain the volume of water which these people have the means of collecting when the water is on?—I am just now testing it. I have had a tank made which I am having moved from house to house, to measure the actual quantity of water supplied to them from day to day, but up to this time I am not able to give you any information. When I have completed my examination I will send you a report. I am going through the whole of the district I have referred to at the instigation, or rather at the request, of the united vestries that I have spoken of.

3317. What is the smallest quantity you have yet met with?—The quantity stored is not more than 10 gallons per house for a whole house.

3318. Do you mean for a house containing nine or twelve persons?—Yes, most of them contain as many.

3319. That is quite inadequate, is it not, for the supply of so many persons in a house?—Yes.

3320. Where do those people obtain water from for their necessary purposes?—I cannot imagine. I think it must be their habit not to use water to wash their houses with or themselves, and the little they use is to make the tea they drink.

3321. (*Chairman.*) Supposing that your parish had parliamentary power or other authority to deal with a company on behalf of the whole of the inhabitants to supply water to them, having power to levy an adequate rate, and that the means of supply were at your disposal stored in a cistern or other arrangement, do you think you could so map out your district and so control the supply, purchasing in bulk, as to give them a very much better supply than they have now, and at a cost not much greater?—I think we could give them a better supply than they have now at less cost, and a constant supply.

3322. If your parish had that power and gave you the necessary assistance, do you see your way to managing the distribution of the water, so that it should neither be wasted on the one side nor be scanty on the other?—I do. I think there would be no difficulty in it whatever.

3323. You would be supplying water to the whole at a very much less cost than each individual could obtain it for himself?—No doubt of it, taking the ordinary price which the company are permitted to charge—sixpence per 1,000 gallons—and applying that to the consumption of an ordinary household, I am satisfied that we could distribute the water much to the benefit of the water-ratepayers.

3324. Then the distributing apparatus being the property, or rather, if not the property, under the absolute control of the vestry, so that you might dictate the best form of apparatus, you could give those poor creatures an abundant supply, and it would not cost them more than it costs them now?—That is my impression.

3325. And it would be clearer water?—Yes.

3326. You would see that the tanks were kept clean?—I should not put up a tank in a house at all. I am now making an application to the company for permission to put up a block of houses of my own, and I propose to put a cistern in the centre, the water to be supplied by meter to that cistern, and then I shall supply my tenants.

3327. I meant, that each house should have a full supply, but you would make such an arrangement that you would be able to supply it to them at a much less cost than putting a cistern in each house?—Yes; and there would be no waste.

3328. (*Mr. Harrison.*) Would there not be an advantage as well in case of fire, from having a tank such as you describe?—Yes. We know that a pail of water would frequently extinguish a fire, when for want of it a house is destroyed.

3329. Would you put the tank at such an elevation as to be able to throw water over the houses in case of fire?—No, I should not be able to do that; it must necessarily be at the tops of the houses to throw it on to a house on fire, and I think it would not be advantageous for a water supply to the inhabitants, the pressure would be greater than was necessary, which would consequently lead to waste.

3330. In the case which you mentioned just now of there being inadequate means for the collection of water, and where the poor inhabitants had only 10 gallons to a house, was a house charged for the water supply according to its rental?—Yes.

3331. It was no fault of the water company that the supply was not larger, but from a defective arrangement in the house; it was the landlord's fault?—Precisely so. I believe there are many instances in which the time for which the water is turned on is inadequate for the supply. I know that there are many instances where the time for which the intermittent supply is on is not sufficient for the Saturday and Sunday requirement.

3332. How do they arrange the length of time for which the water shall be turned on?—What the plan is I do not know, but it appears to be for about 20 minutes; that seems to be their regulation, that each district shall have the water supplied for that time.

3333. Are many of the poor people in your neighbourhood employed in such a way that none of the family are left at home?—No; it frequently happens that the children are locked up in the rooms, while the parents are out, the whole day.

3334. How is the water kept in those houses?—It runs into a tub in the back yard.

3335. When that tub is filled what becomes of the overflow?—It runs to waste.

The witness withdrew.

Adjourned to Tottenham on the 18th instant.

TOTTENHAM.

W. Hall, Esq.

18 Dec. 1866.

Tottenham, Tuesday, 18th December 1866.

PRESENT:

ROBERT RAWLINSON, ESQ., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, ESQ. | Professor JOHN THOMAS WAY.

WILLIAM HALL, Esq. (Tottenham), examined.

3236*. (*Chairman*). Are you chairman of the Local Board of Tottenham?—I am.

3237*. How long have you been resident in Tottenham?—32 years.

3238*. How long have you been connected with the local board?—As medical officer I have been connected with it more or less from its formation.

3239*. Has the local board carried out certain sewerage works, waterworks, and house drainage to a considerable extent?—Yes.

3240*. Do you know what becomes of the sewage after it leaves the sewers?—It passes into our works.

3241*. Have you any disinfecting works?—Yes.

3242*. Can you give the Commission any general statement as to the health of the district before and after the works had been carried out?—I can most decidedly. I made a report, which perhaps came under your notice before those works were introduced.

3243*. Have you a copy of that report here?—I do not think I can refer to it, but it was sent to you, for I observe that in some of your reports you have made extracts from it.

3244*. What was the character of the disease that prevailed in this district before you undertook your works?—Endemic fever was certainly the great characteristic of this locality.

3245*. Since you have carried out your works have you any reason to believe that the health of the inhabitants has improved?—Vastly; for the first few years after the completion of those works I thought we had almost banished fever, but within the last four or five years we have been suffering from overcrowding, which has brought it amongst us again, but it does not haunt the same localities that it did before the works were completed.

3246*. Do you think that fever is now more attributable to overcrowding than to any other cause?—Decidedly.

3247*. Can you briefly describe the locality in which fever now prevails, if there is any?—We have just got a few cases, but it is nothing now in comparison to what it was. The locality in which we have it principally is in the district where some speculating Jew builders have run up a number of miserable habitations, where there are in some 16, 18, and 22 persons living in little four-roomed houses—the Whitehall estate, I think it is generally termed.

3248*. Have you not, as a local board, power to regulate the mode in which the houses shall be erected?—No.

3249*. Are not the plans submitted to you?—Yes, but we have no power to say of what area the rooms shall be.

3250*. Have you no power to say how many inhabitants shall live in them?—We have, I believe, under a recent Act of Parliament some little power.

3251*. The last Public Health Act gives you additional power?—We expect that, but we have not put it in force just yet.

3252*. Have you framed your byelaws?—Yes.

3253*. In accordance with the regulations provided by the Local Goverment Act Office?—Yes.

3254*. Have they been confirmed by the Secretary of State?—Yes.

3255*. I assume that they do not give you sufficient power to prevent overcrowding?—No.

3256*. How are the common lodging houses regulated?—Very well.

3257*. Are they looked after by the police?—Yes.

3258*. Until recently the law allowed you to regulate a common lodging house as to overcrowding?—Exactly so; we have not tested the law upon that point yet.

3259*. Not under the new Act?—No.

3260*. Do you compel the landlords of the houses to take a supply of water from your works; do you serve them with notices?—Yes, we have power to do that, but occasionally where we have known of it, there has been a great difficulty in providing the supply of water that we could wish to have; when we have known them to have a supply of their own, we have not enforced it. I think it is now pretty general.

3261*. Have there been any complaints of the want of a water supply in any of those places where fever has prevailed, or has it been fostered do you think by the want of a proper water supply?—Upon this very estate to which I have alluded the owners are enabled to evade us. The Act says that they shall have a water supply, but not what supply; they will put on a half-inch pipe perhaps for 30 houses, and you may guess from that how much each house can get.

3262*. Have you had any complaints made as to any pollution taking place at your outfall works?—I may say that there have been numerous complaints.

3263*. Have any complaints been made by the river Lee trustees as to the condition of the outfall water before it goes into the river?—There are certain proceedings pending now upon that point.

3264*. Have the river Lee trustees given you notice of action to restrain you from letting the overflow pass into the Lee?—Yes, and the clerk to the board will give you evidence upon that point.

3265*. Have you been at all interfered with in your works by anything that has been recently done on the river Lee, either by the trustees or by the East London Waterworks Company?—We are seriously interfered with just now by the river Lee trustees. they have obtained a sort of *ad interim* injunction.

3266*. Have any public works or intercepting conduit interfered with you at all?—There is an intercepting ditch for the drainage of the parishes above us, which is a great nuisance to this parish. I believe it was made by the East London Waterworks Company, it is what we call the Catchwater Dyke; it comes from Ponder's End through our parish, and is emptied into the river Lee just above our own works.

3267*. Do you take any water from the Lee for your supply?—No; we do not unfortunately; we take it from wells.

3268*. (*Professor Way.*) Is the water hard?—No; it is water from a deep bore-hole.

3269*. Why did you say "unfortunately"?—Because it has put us to much greater expense, for the river Lee trustees have not been accommodating to us.

3270*. (*Chairman.*) You do not get so much volume?—We think that we ought to have some advantage from the Lee.

3271*. (*Professor Way.*) You cannot take it on account of the opposition of the River Lee Trust?—The East London Waterworks Company I believe have an engagement with the River Lee Trust, and the New River Company too.

3272*. You could not have the river water if you wanted it?—No; not under the present arrangement.

3273*. (*Chairman.*) Are you aware that the New River Company have power to supply water from the river Lee to the adjoining parishes for a considerable

district upwards, far beyond you?—I do not know what area their powers extend over.

3274*. Have you ever entered into any negotiations with the New River Company as to a supply of water?—Yes, and with the East London Waterworks Company too.

3275*. Did both negotiations fall through?—They did on account of the charge. The New River Company does supply the outlying portion of our parish now; the Wood Green portion of it.

3276*. (*Professor Way.*) Do you remember the old works for precipitating the sewage when Mr. Higgs introduced them?—Yes.

3277*. Was that any time before these works were put in hand?—No.

3278*. Were the two things going on simultaneously?—Yes.

3279*. Are those precipitating works in operation now?—Yes, in a modified form.

3280*. It is upon that that the injunction hangs, is it not?—Yes; we have recently sewered the Wood Green district, which is a very populous district indeed, on the other side of the parish. We had made arrangements to deal with the sewage at our works as well as with the sewage of this part of the parish, but the river Lee trustees say, "You shall not bring any addition to the works there," and it is on that question that it turns. The sewers are all laid down, and the parties have made their connexions, but they cannot use them.

3281*. Then the law proceedings do not affect your original works?—No.

3282*. (*Mr. Harrison.*) You stated that the effect of your sewerage works had been to improve the general health of the parish of Tottenham. Have they also diminished the death rate of the parish?—I should say that they have, but our death rate depends a good deal upon this circumstance perhaps: this is a parish to which many little foundlings are sent out of London to be nursed, and the number of them that die add of course very much to the number in the mortality table; but even with that addition our death rate is much below that of London.

3283*. I understood you to say that the improvement in the public health was attributable to your having taken the sewage away?—Unquestionably.

3284*. That does not touch the question of what the state of the public health might be in the neighbourhood of the sewage works where the sewage was dealt with?—No.

3285*. (*Chairman.*) Have you any idea of the number of deaths that annually take place among the children so sent into the parish and not born in it?—I really could not be certain, but I have seen a great deal of it.

3286*. (*Mr. Harrison.*) Your position is this, if I understand you, that the percentage of deaths is always very large during infancy, or that among children under five years of age there is a very much larger proportion of infants in consequence of foundlings and illegitimate children being brought into the parish than would ordinarily be found in parishes where there was no such unusual influx?—That is the case, I think, in most of the parishes in the neighbourhood of the great metropolis. I believe the death rate is not a fair criterion of the health of this parish.

The witness withdrew.

Mr. William Heath (Tottenham) examined.

3287*. (*Chairman.*) You are a solicitor practising in Tottenham?—No; I practise in the city, but I am clerk to the board of health here.

3288*. What length of time have you been clerk to this board?—For about 15 years, from its first establishment in 1850.

3289*. For what length of time have you known Tottenham?—For about 20 years.

3290*. Do you know the river Lee?—Yes, very well indeed.

3291*. Do you know it sufficiently well to be able to speak to its condition before the works were carried out here?—Yes, I do.

3292*. In what condition was it then?—I should say that as far as this parish is concerned the amount of filth and drainage of various kinds which flowed into the Lee was larger than it is now. The ditches were in the worst state generally.

3293*. Was the refuse from the houses at that time passed into the ditches, and so sluggishly passed down those ditches into the Lee?—Yes; the overflow. The place was sewered by the old-fashioned cesspools, and the overflow from them found its way into open ditches, and discharged itself into the Lee navigation.

3294*. The overflow being in a putrid condition?—Yes.

3295*. After festering in the surface ditches it slowly crept along and got into the Lee ultimately?—Quite so.

3296*. The Lee was then more foul than it is now?—Yes, it was.

3297*. Have you any idea what addition has been made to the population since the local board was established?—I think nearly 50 per cent. Its population in the last census but one was about 9,000; that was in 1851, and in 1861 it was 13,000. In some instances I may say that the drains were made from the houses into those open ditches, so that it was not simply the overflow from the cesspools.

3298*. That was before the board was established?—Yes. In 1851 the population was 9,120, and in ten years afterwards, at the last census, in 1861, the population was 13,239.

3299*. Can you form any rough estimate as to what it is now?—I think it has increased very largely indeed, and particularly in the Wood Green district; it is not less now than 16,000.

3300*. The Lee, I suppose, is navigable through Tottenham?—Yes.

3301*. Does the East London Waterworks Company take its water below you?—No, above Tottenham; it is not affected by the state of the river Lee in Tottenham.

3302*. The parties who have been indicting you are the River Lee Trustees, and not the East London Waterworks Company?—Yes.

3303*. Are the East London Water Company joining with the River Lee Trustees in the proceedings?—I am not aware that they are; I hardly think so. The Trustees have already filed their bill in Chancery, and have obtained an interim injunction pending the hearing of the cause, which will take place in a few weeks. The interim injunction does not extend to the drainage of the parish generally, but simply to the Wood Green district. We laid out about 7,600*l.* in sewering that district; it is now an outlying district, but the population has increased so rapidly within the last few years that it became necessary to provide some drainage for that locality as well, and the board laid out the sum of 7,600*l.* in laying down a main sewer from their works to Wood Green. We were about commencing to connect the houses with that main sewer when we were stopped by the interim injunction.

3304*. Can you state about the date at which the board commenced their works, and the sums of money they have borrowed?—We commenced the works shortly after the board was established; the first thing we did was to obtain a plan on a large scale, laid down by the General Board of Health, of the entire district and that occupied something like nine months. The board was established in 1850; the works, I think, were in operation in 1852, and the main sewer was laid down in that year. Of course it took some time to make house connexions, which were made about the year 1853. Mr. James Pilbrow was the engineer then.

3305*. Did he devise the main sewerage and the waterworks?—Yes.

TOTTENHAM.

Mr. W. Heath.

18 Dec. 1866.

3306*. How much money did you borrow for the waterworks, and the main sewerage, road improvements, and paving?—About 55,000*l.* and some odd pounds, including the roads.

3307*. What is the rateable value of the parish?—The rateable value in May 1850 was 42,816*l.*, and the rateable value in May 1861 was 58,047*l.*

3308*. Is it annually increasing?—Yes.

3309*. As you add new buildings and bring new property into operation you add to your rateable value?—Just so; it has increased in the last half year about 6,000*l.*; but that is hardly a fair criterion of the gradual increase, inasmuch as the Union Assessment Committee, appointed under the recent Act, held their sittings in Tottenham some time ago, and the assessable value of the bulk of the parish was considerably raised; therefore it can hardly be taken as a fair criterion; it does not show the gradual increase.

3310*. That gives an explanation of the sudden increase?—Yes, of 6,000*l.*

3311*. Has anything been done in your opinion to interfere with the efficiency of your sewerage outfall works?—The filing of the interim injunction has put us to very serious inconvenience, because as new houses are being built they have no means of drainage, and they are obliged temporarily to make small cesspools in the hope that something will be done.

3312*. Has anything been done in the way of works to make these works of yours less efficient than you think they were formerly?—Certainly not, they are as efficient now as ever.

3313*. I suppose you treat the sewage with lime, and take the sediment deposited out of the tanks?—Yes, the solid matter does not go into the navigation.

3314*. Have you been at all troubled with sewage and filth from the Catchwater Dyke from Enfield and Edmonton?—Yes, we have a good deal; a large quantity of filth comes down from there.

3315*. Does that pollute the river?—No doubt of it, very materially.

3316*. I suppose, if they deal fairly with all parties, they will indict the local boards of Enfield and Edmonton?—Certainly, and I may remark here that I am sorry the Commissioners had not an opportunity of inspecting the river Lee about a month or six weeks ago, when the water was drained out. If so, they would then have seen whether the nuisance complained of by the trustees resulted from the operations of our board, or what the real cause was. Between the outfall of this Catchwater Dyke and the works of the board there was an immense amount of filth in the bed and on the banks of the river between where the Catchwater Dyke enters the river Lee and our works

3317*. And some from Enfield and Edmonton?—Yes, and Ponder's End, not from our works, but all above our works. I would suggest to the Commissioners that they should apply to the trustees of the river Lee to have the water drawn off that they may see the condition of the bed.

3318*. Is the tenor of the injunction to restrain you altogether from passing your sewage into the river Lee or to restrain you from passing any additional sewage into the river?—It is to restrain us from passing in the additional sewage from the Wood Green district.

3319*. Your offence is not that you are going on as you have heretofore been doing, but that you wish to add to the original amount of that drainage?—Yes.

3320*. (*Professor Way.*) Do you propose to increase your means of dealing with the sewage, so as to comply with the terms of the injunction?—Yes, we have purchased an additional quantity of land, some of the surplus land belonging to the Tottenham and Hampstead Railway Company, and we bought it for the express purpose of constructing depositing tanks, and so forth, all of which will appear on the affidavits.

3321*. (*Chairman.*) Have you inspected the irrigation works at Croydon or at any other place?—I think our surveyor has, and I believe some of the members also have been there; I have not.

3322*. Have you at all discussed at the board that mode of disposing of the sewage?—Yes, it has been frequently discussed by the board, and an experiment has been made on a small scale, but I believe the opinion of the surveyor is that there would be some difficulty attending it on account of the peculiar nature of the soil, it being stiff clay. I know that that has been the prevalent opinion amongst persons generally.

3323*. Does land bear a very high relative value here for agricultural purposes?—Rather so.

3324*. Land immediately outside the town would fetch a price beyond its agricultural value?—Yes, it is looked upon, in fact, as building ground.

3325*. Should you have any difficulty in getting the necessary quantity of land?—Yes, extreme difficulty. I do not see any land that is available except the marshes, and some pumping apparatus would be necessary.

3326*. I suppose we may say that as a board you have not taken that question up very seriously?—No, but we have found the difficulty so great in obtaining land that we thought it almost hopeless. We have made applications to the Metropolitan Board of Works to take us into their system of sewerage.

3327*. Have you made a written application to that board?—Yes, there is an application pending now. A letter was laid before the Metropolitan Board of Works last Friday.

3328*. Will you furnish this Commission with copies of your applications and of any written replies you may have received?—Yes.

3329*. Can you state now the tenor of their reply?—We have received no written replies at present; the negotiations have been principally through our surveyor up to this time, but a short time since the matter was very serious, the question of the drainage of this and the surrounding districts has been considred, and this board called a meeting of the surrounding parishes, some eight or ten of them, to consider the general question of the drainage of that particular area. A committee was appointed to consider the question, and a meeting of the committee was held about a week or 10 days since, but only four of the parishes then united in the matter; the other parishes, from various causes, withdrew after the original meeting, and there were, I think, three parishes, and the visiting committee of the Colney Hatch Lunatic Asylum, who united in making a general application to the Metropolitan Board of Works for permission to allow Mr. Bazalgette to give an opinion as to the best means of draining the three parishes of East Barnet, Tottenham, Hornsey, and the Colney Hatch Lunatic Asylum, which I should state had been complained of very much by the Edmonton board as having been a source of great nuisance to that parish and a small part of our parish.

3330*. Are you of opinion that a combination of the parishes and townships in the district would be the most effectual method of carrying out the intercepting works that might be found necessary?—Decidedly so.

3331*. Do you think, with your knowledge of the legal powers which exist, that it would be necessary to have any new machinery to bring all the parties concerned in?—Yes; I am afraid that there are no existing powers to enable it to be done, and that it would be necessary to obtain an Act of Parliament.

3332*. If the river Lee in its entirety were put under a conservancy board with a view to suppress nuisances throughout its length and breadth, and to compel combined action, do you think that would be a benefit?—Yes.

3333*. If the necessary works were carried out in the most effectual way?—Yes.

3334*. With combined action on the part of a number of parishes which might enable them to carry out more efficient works than if they acted singly?—Yes, quite so. I imagine it would be necessary in that case to take in the whole valley of the Lee from Hertford, and not to confine it to the few parishes that were assembled together. We confined our operations to those parishes the fall of which is

through our own parish, and which were suffering with ourselves, and being joint sufferers we limited our inquiry to those particular parishes. In my opinion any general scheme should embrace the whole valley of the Lee.

3335*. Did you find difficulties in dealing with the small number of parishes which are affected like your own?—Yes, and so great that I think they are insurmountable, nothing but action on the part of the Government, which would compel parties to come in, would be effectual.

3336. (*Professor Way.*) In that case you would be independent of the metropolitan system altogether?—Quite so, that is, if they refused to take us in. Looking at the large increase of the population that is likely to spring up within their present area, I believe it is thought that their sewers are not sufficiently large to take in sewage from other districts. I believe that that is Mr. Bazalgette's opinion.

3337. (*Mr. Harrison.*) How far does that intercepting sewer extend up the valley of the Lee?—It comes down I believe from Ponder's End to Tottenham Mills, about a quarter of a mile above our works.

3338. The district throughout the whole distance between this and Hertford is becoming populous by degrees?—Yes, and of course the nearer you come to London the more rapidly the population is increasing.

3339. The houses are almost continuous now to Hertford, are they not?—Hardly so, but as far as Ponder's End they are. I may mention that there is a very large amount of filth, which flows along the ditches into the river Lee between this and Hertford, from Waltham, Cheshunt, and Ponder's End.

3340. Have any complaints been made by your board to the East London Water Company as to the intercepting sewer?—No; it was made by virtue of an Act of Parliament, and we did not think it was worth while to make any complaint upon the subject; there was a special Act passed, although we think, perhaps, that the powers given by the Act have been exceeded. No doubt the intention of the Catchwater Dyke was to provide for the drainage then existing; it did not contemplate carrying the sewage directly into the Catchwater Dyke.

3341. That not only takes the sewage but the flood water of the district above?—Yes.

3342. So that all the water falling upon the district adjacent to that passes into it, and into the river Lee, below the point from which the East London Waterworks Company take their supply?—A great deal of it does—that which is not carried off by the other ditches and streams.

3343. (*Professor Way.*) Is any use made of the Lee water below Tottenham for domestic purposes?—To a certain extent I understand it is.

3344. It does not furnish a water supply of any consequence?—No; not on any large scale.

3345. The complaint against you would be, not of fouling the water for the supply of the town, but of a general fouling of the water?—Yes.

3346. The injunction which is pending refers to the question of the Wood Green sewage?—Yes.

3347. And that will be tried on its merits?—Just so.

3348. If that decree is made perpetual will that affect the question of your other works or will it not in point of fact condemn the principle?—It would place us in a difficulty, as one part of the parish only would be drained, and in fact a great portion of the expense which has been incurred in draining the other part of the parish would be rendered futile.

3349. You have done something with the Wood Green district other than the method you are pursuing in the other?—Yes.

3350. If the Vice-Chancellor should decree that you shall not do what you have already done with the rest of the sewage, shall you not have to resort to some other plan?—Yes.

3351. You will have two systems under your jurisdiction; dealing with the sewage by precipitation has been condemned inferentially, and probably the improved method of dealing with the sewage in the case of Wood Green will be prohibited?—Yes.

3352. Will not that be a very awkward condition of things for you?—Yes, very awkward indeed. The fall from the Wood Green district is entirely in this direction, and if that is drained by the old system of cesspools, the overflow must get into the ditches and contaminate them, and a large portion of the expense incurred will be utterly useless. I think there ought to be a general system of some kind applicable to the entire parish.

3353. When were the works that have been executed first carried out?—Some few years after the board was established. I think in about 1854.

3354. Twelve years ago?—Yes, just after the house drainage was carried out, and private improvements. In the first place we laid our main sewers and our water mains simultaneously.

3355. Were they arranged for the probable increase in population?—Yes; a certain amount of increase of population was anticipated, I believe, by Mr. Pilbrow, but not sufficient to meet the requirements of the case. We have had to increase our works, and to enlarge some of our water mains.

3356. I am referring to the precipitating works?—They have not been enlarged.

3357. Have you found any difficulty from the size of them with the increased quantity of sewage consequent upon the increased population?—I think they would be improved if there were some additional depositing tanks, and we have recently bought about an acre of land for that purpose.

3358. Was that with reference to the Wood Green district?—Yes, and to the district generally.

3359. (*Mr. Harrison.*) Was it proposed by you to deliver the sewage after passing it through the process into the river Lee by a new outfall?—No; by the present outfall, there is only one.

3360. (*Professor Way.*) Do you consider that you have a prescriptive right to carry the drainage into the Lee?—Yes; we have a prescriptive right to take the drainage into the river Lee; it always went there. We say, as far as this particular parish is concerned, that the amount of filth which goes into the navigation is far less now than it was at the time of the establishment of our works. I ought to mention as to the Wood Green district that before this sewer was laid down recently all the drainage from the Wood Green district was passed through our ditches into the river Lee. That was before it became increased by the increase of population, and I should not give a complete idea as to the drainage of Wood Green, unless I said that a much larger quantity of drainage comes down our ditches from a large part of the parish of Hornsey and South Hornsey. That was the subject of the lawsuit between this board and the sanitary authorities at Hornsey sometime ago. We filed a bill against them because the nuisance had become so intolerable, and a large amount of sickness had been caused at Wood Green by a large sewer that they carried out in connexion with the Muswell stream, and we filed the bill against the sanitary committee. Unfortunately there was no local board established there, the sanitary committee being the only committee chosen and appointed under the Nuisances Removal Act. When the case was called on before Vice-Chancellor Wood, the difficulty that we experienced was this, that there was no public body against whom we could proceed, and the law was in such an imperfect state, that all the Vice-Chancellor could do was to make a general decree that the local authorities at Hornsey should bring no additional sewage through Tottenham. But we were obliged to put up with the existing sewage, which was a very great nuisance; this was before the passing of the recent Act, but under that Act we shall probably have enlarged powers.

3361. Is not that an additional reason why some general legislative measure should be passed for a conservancy of the entire river Lee and its tributaries?—Yes, decidedly so, because that nuisance which is

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very great now is increasing every year from increase of population.

3362. Are you not doing for Hornsey what the river Lee trustees are doing for you?—Not now; we were doing so. We took proceedings against them, because we thought that the complaint which was made by the trustees of the river Lee arose, not so much from what we were doing as from what other persons were doing, because they sent their sewage through our parish.

3363. Is there anything further that you think you can add to your evidence?—I think not.

The witness withdrew.

Mr. Peter P. Marshall, C.E. (Tottenham), examined.

Mr. P. P. Marshall, C.E.

3364. (*Chairman.*) You are surveyor to the local board of Tottenham?—Yes.

3365. How long have you acted in that capacity?—For about nine years.

3366. What is the area of the parish of Tottenham under the jurisdiction of the board?—4,624.

3367. It is a very large area?—Yes.

3368. Are the whole of the highways within the parish under your charge?—Yes.

3369. Do any turnpike roads pass through it?—Yes.

3370. You have nothing to do with trustees of roads?—No; we have not.

3371. You have a system of sewerage I assume in Tottenham?—Yes.

3372. Was that laid out in the first instance by Mr. Pilbrow?—Yes.

3373. Has there been any other surveyor between him and you?—No, there has not.

3374. You have taken up the works as they were left by Mr. Pilbrow?—Yes.

3375. All that has been done since you have done?—Yes.

3376. Were you surveyor at the time when Mr. Higgs devised and carried out his disinfecting works?—No; they were in operation when I came here. Mr. Higgs was then living, and carrying on the works.

3377. Do the works remain now as they were established by him?—Yes.

3378. Was there not a large liming tank in which he treated the sewage?—Yes, and that is there now; in fact, everything stands as he left it.

3379. Is it used now as it was then?—No.

3380. You do not use the large liming tank?—Not the upper one.

3381. Do you carry on the liming and disinfecting process in a similar manner to what he did under the terms of his patent?—No; it is not the same, we do not use the upper tank, but we put in the lime.

3382. Do you use disinfecting material in a similar manner, and as much?—Yes, quite as much.

3383. Do you know what price Mr. Higgs anticipated getting for the sediment when the sewage was so treated by himself in the first instance?—I think it was about 5*l.* per ton that he expected to get.

3384. Was any of it sold for that price?—I believe there was. When they sold us the works we sold the remains of deodorised sewage that were left there when Mr. Higgs' people broke down. There was a very large quantity in various forms left on the premises, and they said they would like to take it away, and there was a sale by auction, but I believe that the amount that was got for the whole did not pay for the expenses of the auction.

3385. The trustees of Mr. Higgs' estate asked for leave to dispose of it, and it was sold by auction?—Yes; I should mention that the whole affair fell into the hands of Messrs. Baxter, Rose, and Norton, who supplied the funds to establish the process, and when we bought the works from Mr. Baxter he said that he should like to have the remainder of the manure disposed of, and we ordered Mr. Richards, the auctioneer, to sell it, but it appears that he said that the less we said about it the better, for there was not enough received to pay the auctioneer's expenses.

3386. Do you know upon what terms the works fell into your hands?—We bought them absolutely as they stood.

3387. Did you pay anything for the patent right to use the disinfecting material?—No; it was not asked for.

3388. Do you know what proportion the sum paid by you bore to the first cost of the works, did you pay the first cost, or only a part of it?—We paid nothing like the first cost.

3389. Do you know what the first cost was?—No further than that Mr. Baxter said he had spent upwards of 2000*l.* I think we gave 500*l.*; the land belonged to the board.

3390. You had allowed Mr. Higgs to put up his works there?—Yes.

3391. You gave 500*l.* for all the buildings as they stood?—Yes.

3392. And you have gone on using the ordinary liming tank since?—Yes.

3393. Do you dispose of the sediment now for agricultural purposes?—Yes, we do.

3394. Do you know what weight you take out per week, or month, or year?—Not exactly; but the quantity does not come to very much. I think we have got out perhaps 50 tons when we cleaned it out, and we thought there might be from two to three tons a week.

3395. That would make about 100 tons a year?—About that; that is weighing it when it is rather dry. The sewage deposit loses in weight very considerably by drying.

3396. Have you any difficulty in getting rid of it now?—No, not when it is ready to cart, but we cannot get any remunerative price for it.

3397. What do you get for it?—We generally sell it in a heap to any person who is handy to cart it away, and they will give from 5*l.* to 8*l.* or 10*l.* for it, according to the quantity we have.

3398. Does that amount to 1*s.* or 1*s.* 6*d.* a ton?—Perhaps that, or 2*s.* 6*d.* We extract a great deal before it passes into the tank, which is rather valuable manure; it has never been treated with lime, it is fresh, and it is considered more valuable than the other part.

3399. How many gallons of sewage a day on the average have you to deal with?—The amount varies at different times, but the pipe is an 18-inch pipe, and taking it as running at about 13½ inches of water, that gives about 700,000 gallons in 12 hours.

3400. Is it running all the 24 hours?—Yes; sometimes it is not so high as that, and sometimes it is fuller; in wet weather it sometimes runs quite full; in the summer time I have seen it considerably below that, probably delivering only half that quantity.

3401. Have you any means of dealing with the full pipe of your settling tanks, or do you allow the sewage to run through the tank?—Yes; lately we have, right into the river, in the same way as the other does.

3402. It takes its chance of taking out the sediment then?—Yes; through a sort of filter that we have.

3403. Is the liming process carried on night and day?—No.

3404. What power have you at work in mixing the lime?—We throw the lime into a little tank outside, and it mixes itself in with the sewage.

3405. What weight of lime do you use in a day or a week?—In the summer time we use more than in the winter time. I think in the summer time it is a cubic yard a week.

3406. (*Professor Way.*) Does that weigh half a ton?—Yes, quite that; that is in the very worst period, the hottest time; we used more this year than ever was used before.

3407. (*Chairman.*) From what amount of popula-

tion does the sewage flow into and through the tank?—From the whole population of the lower district, we estimate it at about 7,000 or 10,000.

3408. What number of watercloseets would there be for that population?—There is a watercloset on the average to every house, with the exception of the very small ones; sometimes we have a watercloset to two or three or more houses; but I think I might say there are 2,000 watercloseets.

3409. Connected with that system?—I think so. This is a survey that I made of the old works with a sketch of some proposed new tanks (*handing in and explaining the same.*)

3410. (*Professor Way.*) Is the lime put in by hand?—Yes; there is a man there both day and night.

3411. And you get a quantity of solid matter in the tank?—Yes, it very soon fills up.

3412. (*Chairman.*) What can you get a ton for it?—We sell them the two; a man will not take the one without he gets a little of the other, and we sell them off in lots.

3413. How much a year does it cost you to work these outlet tanks?—It costs us a little more than the wages and the lime at present. I should say that it costs us perhaps 100*l.* per annum now.

3414. Does the lime cost you 100*l.*?—No, we employ a man, and we pay him about 12*s.* or 18*s.* a week; another we pay 1*l.* a week, the two together and the lime will come to about 150*l.* a year at the outside.

3415. What return does it make you?—Very little.

3416. 20*l.* a year?—Not much more than that; it is an unprofitable affair, if we had worked the tanks it would have been still more expensive.

3417. You mean according to Mr. Higgs' first process?—Yes, because the sewage has all to be pumped up into the upper tank.

3418. What is lime worth per ton in Tottenham?—About 1*s.* a bushel.

3419. How many bushels are there in a ton?—About 36.

3420. Does it cost you about 36*s.* a ton?—Yes, we use the ground grey lime.

3421. What do you pay for that a ton?—About 12*s.* a cube yard; that is about half a ton.

3422 (*Professor Way.*) You say that you sometimes use half a ton in a day?—Yes, during the summer throughout the parish.

3423. On the average do you use a quarter of a ton a day?—I do not think so.

3424. (*Chairman.*) Are there any cesspools remaining in that district, the greater part of which drains down to the outlet?—None almost.

3425. You may speak of that as the sewer drain and watercloset district?—Yes, completed.

3426. (*Mr. Harrison.*) Do not the New River Company carry out the same system of purification at Hertford?—I have not seen the Hertford works, but I believe they are somewhat analogous.

3427. Have you taken any opportunity of examining the effluent water from the Hertford works in order to compare it with the water from your works—No, I have not.

3428. (*Chairman.*) Have you ever tried sewage irrigation below your outlet?—Yes.

3429. Upon what area of land?—About 40 acres; we obtained the consent of the occupier to lay down some irrigating sewers, that was about two years ago.

3430. Did you supply the sewage by gravity, or had you to pump it?—We had to pump it up to a certain height, and let it flow by gravitation over the land.

3431. For what time did you continue the experiment, and at what time of the year?—We began, I think, in the beginning of the summer.

3432. Of what year?—It is now two years ago; in 1864 we pumped the water up through the main that we laid down for the purpose, and allowed it to flow through channels cut on the contour of the hill, on to stiffish clay soil, and the great difficulty was on the part of the people who owned the land; they would not allow the grass to be cut more than once, and they will only permit us to irrigate it at their will and pleasure. The application of the sewage has been very satisfactory to every person as far as both purifying the sewage material, and increasing the growth of the grass, but during the winter months, or indeed as soon as the occupier got the hay off, horses and cattle were put into the field, and they poached up all the ditches, so that we could not carry on the system.

3433. You irrigated the natural grasses of the meadow?—Yes.

3434. No particular cost was gone to to prepare it specially for irrigation?—Nothing but cutting the irrigating channels that were necessary to conduct the sewage along the contoured face of the hill.

3435. It was successful until it was interfered with by turning the cattle on during the winter; they trod down your channels, and paddled up the surface?—Yes, they made a mess of it; the occupier did not attend properly to it.

3436. If that small piece of 40 acres had been under your own control to deal with as you thought best, do you think you saw in that experiment results which might have been secured continuously?—I am perfectly certain of it.

3437. You could have got a large increase of produce and have carried on the works so as to purify the sewage?—Yes; if we had had a sufficient area of land, and had had it under our own control, it might have been adapted for the purpose very perfectly. Our sewage might have been cleared. There would have been no smell and a wonderful growth of grass.

3438. If that could have been brought about, I assume that you would have advised your board to apply the sewage to the land, and after that to sublet the land, and the sewage to be worked under stipulations that you might dictate?—Yes, that is the view I take of it, and, indeed, the only way is for the board to get possession of the land and make the necessary works, and then afterwards offer them to the highest bidder. I believe that they would receive a sufficient return to pay them for the expense.

3439. Would it not save them the present outlay they are making on disinfecting works?—Yes, I think there is no doubt of it.

3440. Would it not also prevent them from getting into litigation with the river Lee trustees?—Yes. The only difficulty is our close proximity to London. There is a most violent prejudice on the part of the people here against sewage irrigation, and not only amongst the people who live near it, but amongst the farmers generally in the neighbourhood; they will not use it. We offered to lay it on to a farmer's land, and he said that he was quite satisfied it would kill his crops if it was allowed to run over his ground.

3441. (*Professor Way.*) Your proximity to London will ultimately be an advantage to you as offering an outlet for your produce?—Yes, but that is more than counterbalanced by the terror that people have of it.

3442. But that, I should think, is only transitory?—I think not.

3443. (*Chairman.*) Have you witnessed the Croydon mode of irrigating land?—Yes.

3444. Recently?—No.

3445. Have you seen the irrigation as carried on at South Norwood?—No.

3446. Do you know that the sewage there passes on to stiff clay?—I believe it does. We found that the clay and the grass so clarified the sewage as to make it as clear as crystal—so clear that one member of the deputation tasted it, and could not taste anything in it; but the value of land here is so great that owners would ask for land for the purpose 1,000*l.* an acre, and they are so terrified and alarmed lest it should injure other places in the neighbourhood in a building point of view that if we are going to have a sewage farm I am sure we must get sufficiently far away from this neighbourhood.

3447. (*Mr. Harrison.*) If you were to carry the sewage towards the marshes would it be the same?—The marshes, being common land, are very much used for recreation grounds, and I apprehend there

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would be great difficulty in getting permission to turn them into sewage meadows, for then they could not be used as recreation grounds.

3448. (*Chairman.*) Any more than you could use them for grazing purposes?—No.

3449. You say that any smell there might have been in the sewage was immediately absorbed. Was it in the summer time when you carried out the experiment you have mentioned?—Yes, and we found that if the sewage was properly applied to the land there was no smell; if an excessive quantity was put on it ran forward and collected in pools from the inequality of the ground, and if not properly levelled there might be a smell then.

3450. (*Mr. Harrison.*) Are you aware that a bill is likely to come before Parliament in the ensuing session for the enclosure of these common lands, promoted by Mr. Bailey Denton, the engineer?—There is, I believe, a proposal to drain the valley, and he intends to go to Parliament to obtain a bill to drain some of the low-lying grounds in the neighbourhood of Stratford and Bow. I pointed out to him the advantage it would be if a large sewer was constructed there to continue it up the valley, and so take in the whole of the drainage on both sides. We pointed out the nature of our difficulty as we found it, and we thought the only relief would be to let the sewage be taken to Barking, and thence on to the Maplin Sands. Under these circumstances I believe he has given notice of his intention to apply to Parliament for a scheme to unite the whole of the parishes under one common board, and he proposed to go as far as Waltham. There we found that the East London Waterworks Company had devised a scheme to intercept the sewage of the valley on both sides, and we proposed to catch the sewage there and bring it down through the valley to Stratford, which pumps its sewage direct into the Lee now, and so on to Barking, that it might be dealt with.

3451. (*Chairman.*) Have you any plan showing any proposed works that you have to intercept and carry away the refuse sewage of your own district or the combined districts?—I have made a sketch (*producing the same.*) We find that we are exposed to three great evils.

3452. Have you laid down any scheme for dealing with the sewage upon any plan?—I have laid it down on this inch Ordnance map, which shows the whole of the district outside the metropolitan boundary.

3453. Where do your intercepting sewers begin, and where is it proposed they should end?—I will explain (*describing on the map*).

3454. Does your parish abut upon the metropolitan area?—It does.

3455. You are, like West Ham, just outside the metropolitan area?—Yes; it was proposed to intercept the Lee sewage as it flows from Cheshunt on the west side of the Lee, because the East London Water Company had in contemplation a system of sewerage to intercept the sewage above that, which would join this sewer about Waltham Abbey. We proposed to intercept all the sewage from Enfield, Enfield highway, and the various villages that lie on the main road to London, Tottenham, and Edmonton, and also to receive into the same sewer the drainage from Colney Hatch Lunatic Asylum, which is at present a matter of litigation, and also from Hornsey, which has no outlet in the way of drainage, from Barnet and other districts, there being a natural watershed towards the river Lee.

3456. From the west?—Yes. The eastern catchwater was to go up the eastern side of the river Lee, beginning at Waltham Abbey, to follow the river Lee and take in Sewardstone, High Beach, Chingford, Chapel End, Walthamstowe, and that district which is becoming rapidly populous with no means of drainage. Then it would form a connexion with the sewerage that had been brought from the west side of the Lee, and the two would unite in one channel at High Hill Ferry, upon the west side of the Great Eastern Railway.

3457. Through what district would it then go?—Through the town or village of Stratford, and direct across the Plaistow marshes.

3458. By an independent outlet would the sewage be carried to Barking Creek?—Yes, it would be low down enough to take all the drainage of the low lands there.

3459. To be discharged into the Thames at Barking Creek?—Yes; either into the Thames in the same manner as the metropolitan system does, or to lift it up by pumping into the Maplin Sands scheme, and so go to the Essex marshes.

3460. (*Professor Way.*) What volume of water do you imagine would be taken down in that way?—I have not calculated that.

3461. Do you know what provision is being made, beginning from Barking and going to the Essex Sands, as to the size of the culvert to be constructed?—I may remark that we do not propose to take the storm water.

3462. (*Chairman.*) Only the dry weather flow of the sewage?—Yes, and as little of the other as we can help. We consider, supposing the Maplin Sands scheme would not do, that it would bring us to a point where we could irrigate; it might be turned more to the north, and so get into the low lying lands of Essex.

3463. (*Mr. Harrison.*) Has this scheme assumed any definite shape?—We called a meeting, and notice was given of an application to be made to Parliament for a bill to enable all the parishes interested to combine and form a central sewage area. It was proposed that they should carry out some scheme, we did not say what, for the purpose of making an outlet for the whole of the district, and it was intended that they should all be rated according to their value, and it was thought that the powers of the present Act of Parliament would be enough to enable them to carry out the works. We had a meeting here in Tottenham of the persons who were interested in the matter, and we found after the meeting had taken place, that few of them were inclined to incur the expense of going to Parliament, or to take any course, and I believe that now an application has been made to the Metropolitan Board of Works to ask whether there is any prospect of getting an outlet into their system of sewers. Mr. Bazalgette has been requested to come down here and report upon the matter.

3464. Has the East London Water Company taken any steps to extend their intercepting system above the present point?—Yes, they have given notice, and have deposited plans for a new system of sewers, to have their outlet in the present Catchwater Dyke, which passes through our parish. They begin at Ponder's End, and take the sewer along the high road in Ponder's End towards Waltham Cross; they also take a sewer along the valley to catch the sewage from the Ordnance factory. They then cross the river Lee, and extend their sewage pipes to Waltham Abbey, so that their proposal is to bring all the sewage from Enfield, Ponder's End, Waltham Abbey, and that district, into the Catchwater Dyke that runs through our parish.

3465. Is that Catchwater Dyke complained of by the people in your parish now?—At times it becomes a considerable nuisance, and is complained of.

3466. When the water is low in the summer time?—Yes.

3467. Have you found it to be objectionable yourself?—Yes, and when the Government inspector saw it he said that he thought it was a very serious nuisance—Mr. Morgan.

3468. When was that?—In the last summer.

3469. In what month?—I think it was in July.

3470. Is it part of the East London Water Company's scheme to cover the sewer?—I do not think it is.

3471. If their proposal is carried out to bring sewage from places above Waltham, will not that increase the nuisance arising from the intercepting sewer?—Very much indeed.

3472. (*Professor Way.*) Are you aware that the Metropolitan Sewage Company propose ultimately to deal with the sewage in the whole line of their culvert?—Yes.

3473. Would it not be something like taking coals to Newcastle, to take your sewage to a place where the ground is already occupied by the metropolitan sewers?—Yes, but we cannot apply it here about.

3474. If the metropolitan sewage is diverted to the Maplin Sands, you would not be allowed to discharge your sewage into the river after that had been done?—No. I believe as to the Maplin Sands scheme, that they would be very willing to get more sewage than they have if another system could be devised. We cannot dispose of it so close to London as we are now, and if we tried to send it over the heights into Essex, we must pump it over.

3475. That is if you accumulate the sewage from a number of towns?—Yes; we have sketched out a plan for the purpose of disposing of it by gravitation, by intercepting it at certain points. Our outlet is very little above high-water mark.

3476. (*Chairman.*) Do you know about what length of main sewers you have in Tottenham now?—I cannot answer that exactly.

3477. Are the sewers permanently ventilated?—There is no ventilating apparatus, so called, beyond the connexion of the drain water pipes at intervals with the sewers at high levels, and that we find effects ventilation.

3478. Have you not found any necessity for permanently ventilating them?—No; we have found our sewers remarkably free from smell when opened, because the flow is so rapid through them.

3479. What is the size of the largest of them?—18 inches; it is an earthenware pipe.

3480. Are there any sewers made of brick?—None.

3481. Then Tottenham is entirely sewered by earthenware pipes?—Entirely.

3482. How many years have they been in operation now?—I suppose upwards of 12 years.

3483. Has there been any bursting in that period?—We have had a settlement in the small pipes frequently but not in the mains. We have had as many as upwards of 40 houses in one part of the district, which drained into a $7\frac{1}{2}$-inch pipe, and that was very liable to stoppage, so we removed it and put in a 9-inch pipe.

3484. I believe nearly all the roads throughout Tottenham, which is of great length, are macadamized?—The parish highways are of gravel; the main road is macadamized.

3485. None of the roads are paved?—None.

3486. I suppose there is a large amount of grit formed on the surface of the main roads by traffic?—Yes.

3487. Looking at the character of the district, which is tolerably flat, what is the fall in your outlet sewer?—Very slight; in one place it is one in 1,000, and in another one in 600.

3488. What is the fall generally in your other gradients?—They are all rather flattish; about 1 in 300 or 1 in 700.

3489. What number of gullies is there?—Not one; we do not permit any surface water to go in.

3490. You pass it into the natural watercourses of the district?—Into the old watercourses of the district.

3491. Do you find a difficulty in carrying it off?—Yes; as the district gets inhabited and population increases, it is a very difficult matter to preserve those old watercourses; indeed, it forces upon us a double system almost.

3492. Do you think that that double system would have its advantages if you had to deal with the sewage proper?—I think it would have in that respect.

3493. Does much subsoil water find its way into your system of pipe drains out of the gravel?—I apprehend that it does in those pipes which have been laid down in the old district. As to the ones I laid down I know that it cannot get in, because I laid them down to avoid that.

3494. You know what volume of water is supplied to the inhabitants for domestic purposes, and the quantity that issues from the sewer's mouth. Can you form a notion as to whether much additional volume finds its way into the sewers as compared with what is pumped into the district?—Yes, we sometimes have the pipe quite full.

3495. (*Mr. Harrison.*) Are you speaking of 12 hours?—Yes.

3496. (*Chairman.*) Are the down spouts from the houses connected with the drains?—A good number of them are; I think we get a good deal of water from roofs and yards that we cannot keep out altogether.

3497. When were your waterworks established?—I believe at the same time that the sewage works were.

3498. What did they cost?—The original waterworks consisted of a surface well bore-hole and a small pair of engines, by which the water was pumped into the main.

3499. Was the water drawn from the chalk?—Yes.

3500. Have the works been added to?—Yes; the next addition was made by Mr. Pilbrow, who put up a larger engine and sunk two other bore-holes in a place a mile distant from the former one; then he laid a perforated pipe in a bed of gravel, which underlies the upper clay in the valley, and brought all the water into a tank and pumped from that.

3501. What was the quality of that water from the gravel?—It was very hard and full of iron, so full that every pipe and everything we had was affected by it.

3502. Did you abandon it?—We had no other supply that we could go to except what we got from the surface bore-holes, that is to say, delivering all their water about 10 or 15 feet from the surface.

3503. Have you constructed some additional works?—We have made a new well. In the summer the water from the land springs fell off, and we sunk a well and put down a new set of pumps to the depth of about 65 feet, and we have pumped water from that source during the present year.

3504. Have you gone down into the chalk?—Yes, it is an 18-inch bore-hole at a depth of 260 feet; we have been pumping with a set of three-throw pumps, and in 42 hours we have raised, I calculate, 400,000 gallons.

3505. Is the supply pretty steady?—Yes, we keep the water down at that depth.

3506. Is it as much in volume now as when you first began?—We do not find any difference.

3507. It gives you a steady supply?—Yes, it stands at about what I have stated.

3508. Do you consider that these works are successful?—Yes, as far as they go.

3509. What did those works cost you?—Upon the whole they cost us 2,000*l.* The new well and pumps cost us 2,000*l.*

3510. And by these means you obtain 400,000 gallons a day?—Yes; the new engine was necessary independently of the well, as we had only one engine before.

3511. Are the pipes at all affected by the oxide of iron that you have mentioned?—Yes; I can show you hundreds of yards of pipe which have been destroyed by it.

3512. Do you use that ochrey water now?—During the summer we have very little of it to use; what little we get we use; we use a portion of it now.

3513. Does that affect the other water by mixing with it?—No, it does not; it is only after it stands for some time.

3514. (*Mr. Harrison.*) At what depth is that gravel bed below the surface?—From 10 to 16 feet.

3515. In what direction does it extend?—Right across the whole valley of the Lee. When the East London Water Company were making a catchwater reservoir, they had to cut through this and form a

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puddle trench; they put up temporary pumping engines, and the water in the trench was as clear as crystal, but when it was turned into the Lee, and had mixed with the other water, it began to turn red, and you could see a distinct stream of red water. I believe it is not unhealthy, but it is hard. When they have been pumping through the ditches, the water is coloured by a ferruginous deposit of clay.

3516. Had you much trouble in keeping that water out during the construction of the works?—Yes, considerable, for there was a great deal of it.

3517. Is there any communication between that bed of gravel and the river Lee itself?—I think not.

3518. Why?—Because I think that if there had been they could not have kept the puddle trench clear with their pumping power if the water had come in from the river.

3519. Does the gravel bed extend at all to the westward under the town?—We come always upon it before we reach the London clay. We are getting it now about half a mile from the river.

3520. How far westward from Tottenham across does it extend towards Hornsey?—The beds of clay are so thick there that we have not been able to trace it, but it evidently has a declination towards the west.

3521. Does it get deeper towards the west?—Yes; it has been traced down the whole valley of the Lee. It seems to have been originally washed down from some upper ground and deposited in the Lee; it is much rougher when you get to the bottom than it is at the top; of course the river's action can be traced upon it.

3522. At present you say you are prevented from carrying out a system of sewerage in the increasing part of Tottenham, but what becomes of it in the meantime?—The parts which are not connected with our drains have overflows from cesspools, and these overflows go into the various streams.

3523. Are those cesspools constructed in this bed of gravel?—No, they are in clay in that neighbourhood. The gravel ceases as the sides of the valley rise, and we come directly on the London clay.

3524. Is there a bed of clay lying above the bed of gravel?—Yes, there is a considerable elevation in the Wood Green district, and that is caused by a bed of clay of considerable thickness.

3525. Does that bed of clay extend over the gravel bed at Tottenham and across towards the Lee?—There is a little clay on the top of the gravel always, even at the thinnest part.

3526. Is there between the bed of the river Lee and this bed of gravel a bed of clay?—I think so.

3527. In constructing the reservoirs they used puddle for the puddle trenches?—Yes.

3528. Where did they get the clay from?—There was plenty of clay dug up, and they deepened the puddle trench considerably, but whether they got enough out of the puddle trench to make the whole of the puddle I do not know, but there was a bed of loomy clay on the top of the gravel as well.

3529. And that they used?—Yes; there is a considerable quantity of clay; you may see it at this time for they are making a large quantity of bricks at the side of the reservoir. We have always found a little clay before you get on to the gravel, even at the thinnest part.

3530. (*Mr. Harrison.*) You say that whatever cesspits there are in the upper part of Tottenham they are formed in impervious clay, and therefore there cannot be any communication between them and the gravel bed below?—None.

3531. Is that the case also in Tottenham proper?—No; for instance, in the Page Green district, where an inquiry was made, there the shallow wells are in the gravel; you go through 3 feet of loam and clay on the top, and come to the gravel, and the cesspools that were constructed in that district of course were also in gravel.

3532. There would be a communication in that case between the cesspool and the water in the gravel?—No doubt of it. We have sewered the whole district in order to do away with the cesspools as far as we could; but some people I think in one or two cases retained them.

3533. This bed of gravel to a greater or lesser extent is in communication with some of the cesspools which exist in the neighbourhood?—In our neighbourhood it is not so; in Edmonton there are plenty of cesspools made in it.

3534. Should you not expect that the gravel bed would rise more or less with the valley?—It does.

3535. Then if there are cesspools in Edmonton made in this gravel bed would not they be apt to contaminate the water which you pump from it in Tottenham?—I have no doubt that there is a soakage from those cesspits into the gravel.

3536. Knowing that do you think that that bed of gravel is a proper source of water supply for Edmonton?—I do not think that it is good water, but they use it exclusively in Edmonton and everywhere round the district; they prefer it very much to almost any other water, and a number of people also use it here.

3537. (*Professor Way.*) You stated that it would be difficult at Tottenham to obtain land for the application of the sewage; would it be easier, do you think, to get land in two or three places than to get it all in one spot for the same purpose; for example, could you get 40 acres in one place and 40 in another and 80 elsewhere?—In Tottenham I do not think you could get an inch of land, and I have advised the board to go over into Essex, where we could get 500 acres of land as easily as one, and pump the sewage right over to that land.

3538. (*Chairman.*) I suppose it would be a question between the cost of pumping and making a proper conduit, if you could get land cheap at a distance, and paying a much larger price for it with all the difficulties you have named where it would pass away by gravitation?—I think we could separate portions of the sewage in the upper parts of the district; it could be delivered by gravitation if we could get land in the valley of the Lee.

3539. You think there would be great difficulty because of the cost and the prejudice which exists against it?—Yes; I am certain we could not get any land here. The only feasible plan is to collect the sewage because the variations in the fall are so slight, to get all the sewage down to a convenient point to deal with it, and carry it by gravitation to a proper spot.

3540. If you were by injunction forced either into one scheme or the other, would it by any means purify the whole of the Lee if it left out the other districts?—Certainly not.

3541. Do you think that after they had dealt with you by injunction they would leave all the impurities arising from other districts with increasing populations unmeddled with, would they not take take the same course with them as with you?—Yes.

3542. Looking at it in that light would it not be very advisable indeed that some comprehensive scheme should be undertaken for the whole of the districts which require the same improvement?—I have thought it over with great care, and I am certain that unless some comprehensive scheme is devised, there will be no other satisfactory means of getting rid of the evil, for if we get rid of our sewage we are immediately troubled with the sewage coming in from Hornsey, Barnet, and Colney Hatch, so that although we may purify ourselves we are liable to have the sewage from other places sent in upon us.

3543. I suppose you might have actions brought against you for pollutions in your area which do not originate with you?—We have had that, positively the very thing has occurred. We have now an action pending against us by the river Lee trustees, and we have commenced an action against Hornsey, and Colney Hatch has an action againt Edmonton, and Edmonton has an action against us.

3544. (*Professor Way.*) If any scheme was to originate with the legislature as to the valley of the Lee, I presume it would have the support of your board?—Yes, most decidedly; but the difficulty we have to con-

tend with is in the case of parishes that are rather remote, and which do not immediately feel the pressure and the want of drainage.

3545. (*Chairman.*) Are not the East London Waterworks Company now making intercepting sewers further up the Lee?—Yes, I have given a sort of sketch of it; they propose to deal with the sewage from Ponder's End, Enfield, and Waltham Cross.

3546. The East London Water Company has given notice of their intention to apply to Parliament?—Yes.

3547. (*Mr. Harrison.*) Is there much large traffic to Tottenham upon the Lee navigation?—There is only one wharf, and I do not think there is a great deal, it is mostly to bring building materials and stone for the roads.

3548. Is the greater part of the traffic carried on by the railway?—I think, speaking of local traffic, that the road carries a great deal more than either of the two, the traffic has increased enormously on the roads for building purposes.

3549. How are the people of Tottenham chiefly employed?—A great number of them are engaged in London, and they have their residences down here.

3550. I mean the poorer people?—They are engaged in various ways, a number of them are occupied in various building operations that are going on here.

3551. Are there market gardens to any extent?—Yes, of very considerable value.

3552. Is the produce carried along the road to London?—Yes, it is taken to London in waggons.

3553. Is there much cattle traffic on the railway?—Before the cattle plague the traffic in cattle was enormous.

3554. In your judgment no very decided advantage is gained to Tottenham by the navigation being kept open?—I do not think there is much, it is of course useful for the conveyance of gravel and lime. I may mention that there is a large india-rubber manufactory, and some other factories in Tottenham, which employ a number of hands. We take the sewage from the india-rubber manufactory, and turn it into our sewers.

3555. (*Chairman.*) Is there anything further you wish to add?—Yes; I wish to draw your attention to Leighton, Leightonstone, and Walthamstowe, on the Essex side of the river Lee; no one has yet attracted your notice to those places. The schemes of drainage are of course very imperfect by gravitation, and there is no thorough system, at the same time an enormous amount of pollution must necessarily flow into the Lee, and I know of no way of disposing of it except through the channel of the Lee.

The witness withdrew.

The witness subsequently forwarded to the Commissioners the following Report:—

REPORT furnished by P. P. MARSHALL, Esq., C.E., Surveyor to the Local Board of Health of Tottenham, upon the SANITARY ARRANGEMENTS and the WATER SUPPLY to the District of Tottenham, Valley of the Lee.

The Public Health Act was adopted in Tottenham in 1852, about one-half—being the portion that formed the High Street, on the main road, running parallel with the Lee—was then sewered on the earthenware pipe system. The largest main being 18 inches diameter, the smallest 6 inches.

The 18-inch main is about two miles long, and receives numerous subsidiary sewers, diminishing from 18 inches to the size above mentioned.

The whole of the surface or storm water is supposed to be shut out from these pipes, for it is intended that they should carry off sewage only, the land or storm water being confined to its original channels, whatever they may be. The result is that two sets of drains have constantly to be attended to and kept in good order.

The advantages of this system are the comparitive cheapness with which sanitary works can be carried out in rural and thinly populated districts, and the concentration of the sewage undiluted by rain-water.

The disadvantages are that with the increase of buildings the old open drains and watercourses get interfered with, and as they are mostly on private property and each owner only liable for his own portion it is impossible to get them maintained in a proper state of efficiency, or when it is necessary to have them covered to get the work properly done. Again, they become (as buildings surround them) foul and polluted, and, in reality, a second series of foul drains. Again, every house must have two sets of drains, there is, therefore, a constant endeavour on the part of builders to make surreptitious connexions with the pipe sewers and save the expense of another drain for surface water.

When these works were laid out the question of deodorizing sewage was brought into importance from the very existence of the drains themselves. The cesspool system, so long the only one applied to the collection of sewage in Tottenham, disposed of the solid matter without creating any necessity for a deodorizing agent, while the overflow, if it polluted the ditches and streams, did not then attract much attention.

The concentration of the whole sewage of the district to one outfall raised the question of deodorization. The value of sewage as a material for manuring the land also attracted much attention, and various processes were patented for its deodorization and solidification. Mr. Higgs proposed to precipitate the solid matter suspended in the sewage at Tottenham by the application of lime, and held out sanguine prospects of a large remunerative return from the sale of the solid precipitate when dried and sold in the form of sewage guano.

Tottenham being the first important district sewered on the earthenware pipe sewer system afforded an excellent opportunity for a trial of the patent process. Mr. Higgs saw that with nothing but sewage to deal with the question of deodorization and profitable returns could be best tested, and he succeeded in inducing some influential persons to assist in erecting the necessary works. Accordingly at the outlet of the 18-inch main sewer pipe a sunk tank capable of holding a day's sewage was constructed, with a steam-engine to lift the sewage into an iron tank of nearly similar dimensions which was placed above it. The sewage was then treated with lime, the deposit was run out into shallow squares to dry, made into bricks, dried, ground, and then offered to the public as Tottenham sewage guano.

The liquid was allowed to pass off through the valves in the upper tank, and when the process was properly carried out the sewage water was clear and colourless, but the sewage matter deposited by the lime would not sell, and, although a clear and colourless liquid was drawn off, that liquid still contained all the obnoxious elements of sewage. This would probably have been of little consequence under the circumstances, as the river Lee was at hand to receive it; but the pumping and liming could not be carried on without considerable expense, and as the manure manufactured was considered valueless by those who had tried it, the whole process came to a standstill. Mr. Higgs died, and the works became the property of the local board of Tottenham.

Precipitating by lime is the only method at present adopted, and the tank is cleared out periodically by hand labour. During the winter very little lime is used, but in the summer time three or four bags a day are mixed with the sewage.

The same system has been extended to Wood Green, and the greater part of the whole district has been sewered.

The River Lee Trustees have obtained an interim injunction to stop the extension of the system, and Mr. Bazalgette, Engineer to the Metropolitan Board of Works, has been requested by Tottenham and the neighbouring districts to report upon the question of outfall.

Waterworks.

At the same time as sewerage works were commenced a system of waterworks was designed and carried out to supply the original portion of the district sewered. This has been, from time to time, much improved and extended. The principal supply is derived from wells sunk to the chalk, and some water from land springs in the bed of gravel overlaying the clay in the Lee valley; from 500,000 to 600,000 gallons a day is supplied.

Much leakage has been occasioned by the use of galvanized iron pipes for the smaller mains and house services, the water havin rapidly destroyed such pipes.

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The land spring water deposits a red earthy ferruginous deposit which discolours the water and chokes up many of these small mains and services. This water is also very hard.

Much still remains to be done to improve and complete the drainage of the district, but the great improvement to the general health of the district is well known. Building operations are being carried forward with great activity, and the price of land is steadily on the increase.

In the neighbouring district of Edmonton, where no sanitary works have been carried out, the reverse is the case, and although many grumble at the high rates in Tottenham, builders say that they dare not build where there is no sewerage or water supply.

Area of district.

The area of the district is given by the Ordnance Survey at 4,624 acres, but not more than one-third is built over.

Rateable value.

The rateable value is 91,000*l.* and has doubled within the last 10 years, and is now rapidly increasing.

Population.

The population at the last census was 16,000, but is now estimated at 18,000.

Houses.

The number of houses is 4,000 and they are increasing at the rate of 400 per annum.

Waterclosets.

The number of waterclosets is nearly as many as the houses, as all new houses are provided with them, and have either a supply from the board's works or from the New River Company.

Cost of fitting.

The cost of fitting up waterclosets varies much according to the length of piping required, the board have not of late made any compulsory alterations, nor is it necessary. Every cottage may now be said to have one. The board have never paid any portion of the cost of conversion, but have levied an improvement rate for the same.

Frost.

The recent frost does not appear to have seriously interfered with the use of the waterclosets. It was found necessary during the frost to supply water from hydrants in the street with a stand-pipe, and in one or two cases where the hydrant was opened or shut too suddenly, the main being under pressure, a pipe has been split. This occurred on a 12-inch and 4-inch main; the pipes, however, appeared to have been originally somewhat defective.

Heavy rains.

Heavy rains and sudden thaws flood portions of the district and inundate basements and cellars. When the water in the Lee is very high it is backed up in the main sewer, and the sewage recoils on the basements and kitchens.

Choked drains.

Choked drains frequently occur, owing to the very small pipes laid down and the large number of houses attached to them. We keep a small staff for the purpose of clearing and flushing them, but the cost of cleaning is small in comparison to the very serious inconvenience and annoyance that is caused to the ratepayers, as most of the small drains run through private property, so that gardens, walks, lanes, &c., have to be dug up and disturbed. We inspect all waterclosets regularly, and serve notices to the owners whenever they stand in need of repair.

NOTE.—The sewage works are too small for present requirements, and the board are only waiting the result of Mr. Bazalgette's report before some new arrangement is attempted.

Mr. G. Guy.

Mr. GEORGE GUY (Tottenham) examined.

3556. (*Chairman.*) What position do you hold in connexion with the Tottenham local board of health?—I am inspector of nuisances and turncock.

3557. How many years have you been inspector of nuisances?—About nine years. I have lived in the parish for 23 years.

3558. Of what do your duties consist?—I have to visit the different courts and alleys when complaints are made of nuisances and get the nuisances removed. I also go to the sewage works occasionally.

3559. Do you remember Tottenham before the works were established there?—Yes.

3560. What occupation did you follow then?—I was a sergeant of police at that time.

3561. Did you know anything at all of the condition of the ditches and streams in the vicinity of Tottenham?—I knew that the cesspools emptied into the different ditches, and that the sewage was conveyed into the river Lee in wet weather.

3562. Were those cesspools very foul?—Yes; many of them were very foul in low neighbourhoods, and the contents used to come up under the boards of the floors when they were over full.

3563. Were the ditches in a very foul state?—They were bad.

3564. Do you think that the river Lee is worse fouled now than when you first knew it, before any sewage works were established?—I could not say that, we conveyed our sewage fresh to the sewage works before it got into a putrid state.

3565. Have you anything to do with the place where the sewage is treated with lime?—I only go there occasionally.

3566. Are the men working there under your orders?—Under Mr. Marshall's orders.

3567. You are not the foreman?—No, I go to see how they are going on, and report to Mr. Marshall.

3568. What number of common privies are there in Tottenham now?—I think there are hardly any common privies, perhaps just outside the drainage district there might be one or two.

3569. Are waterclosets generally used?—In most of the houses.

3570. Have the old privies been converted into waterclosets since the board commenced its operations?—Yes.

3571. They were mostly cesspools and privies before?—Yes, formerly they were.

3572. Are there many pigstyes in the neighbourhood?—There are some.

3573. Have you removed many of them?—At times I have.

3574. Are there any large stables, or any other sources of nuisance, such as cow sheds?—Yes.

3575. Are they drained into your sewers or not?—The top water is I think.

3576. Are there any works of any kind that are liable to create nuisance?—I think not.

3577. Do the india-rubber works cause any nuisance?—We have never had any complaint about them.

3578. Do you ever inspect them?—No, but the sewage is brought into our pipe.

3579. Have you any difficulty with road scrapings?—No, the roads are scraped, and the parish authorities sell the scrapings.

3580. For what purpose?—For sand; the builders buy it for sand for building purposes on the bye roads. The high roads belong to the Metropolitan Trust I believe.

3581. What do the people do with their ashes?—We have a brickfield handy, and many of the poor people keep a horse and cart, and they collect the ashes and take them away.

3582. Does the board collect the ashes or not?—No.

3583. Do they leave the disposal of the ashes to the individuals themselves?—Yes.

3584. To do the best they can with them?—Yes.

3585. Do they find a ready sale for them to be used in the brickfield?—I think they give them away.

3586. Have you any charge of the roads as to cleansing them?—Mr. Marshall is the surveyor over the bye-roads.

3587. Have you not any control over them?—If there is any complaint I go to see what the complaint is, and report upon it to the board.

3588. Have you heard any complaints made as to the state of the roads beyond your boundary, the metropolitan roads, or any others; are they better or worse than yours?—I have not heard any complaints made of that sort.

3589. (*Mr. Harrison.*) Does the Metropolitan Board clear the refuse away from their roads in a satisfactory manner?—They scrape the roads on to the paths, and we have many complaints from the shopowners of the dirty state of the sides of the road in the highway; people have complained to the proper parties to get this removed.

3590. Have their complaints been attended to?—Not very freely.

3591. You have no power to enforce the removal of these scrapings?—I do not know, it never was tried. If they were summoned for a nuisance I do not know what it would turn to.

3592. (*Chairman.*) Is it your duty to visit occasionally the outlet works?—Yes.

3593. And if you found the local board accumulating their refuse there to a large extent, so as to become a nuisance, would you indict them?—I do not consider that there ever was a nuisance of that sort at that distance from any such thing.

3594. Do they ever accumulate a large quantity of the refuse taken from the depositing tanks?—We have a great deal at present, and the reason why we have it now is that we cannot get it away, because a new railway is formed, and it takes some time to get it carried in a cart.

3595. How many yards are there now?—I could not say.

3596. 100?—No, I should think not.

3597. Is there any smell from it?—I do not find it myself.

3598. Do any persons complain?—No person has any right to complain there, we are a long distance from any house—we have a man living on the premises.

3599. Do they complain?—Never. I have found Mr. Beardmore there, and he never complained to me.

3600. (*Professor Way.*) Is the man who lives there a man who is employed on the works?—Yes.

3601. If he complained he would be complaining against his bread and cheese, would he not?—I do not know; if it hurt him he would be foolish to stop there to affect his health.

3602. What wages do you give him?—30*s.* a week.

3603. And a house?—Yes.

3604. (*Chairman.*) What family has he?—I think that he has six children.

3605. (*Mr. Harrison.*) Have you ever visited the purification works at Hertford?—Never.

3606. (*Chairman.*) Or the purification works at Luton?—I have not.

3607. Or any other purification works?—No.

3608. You have confined your attention to your own works?—Yes.

3609. (*Professor Way.*) Do you know what farmers this material is sold to?—Mr. Ware, living just by, has bought some.

3610. When did he buy it?—At different times, and Mr. Goddard up here has a field, and he has bought some at different times.

3611. Have they to cart it away at their own expense?—Yes.

3612. How far off does Mr. Ware live?—Some of his land adjoins our works.

3613. Do you find that anybody comes from a distance to fetch it?—No.

3614. Do the same people fetch it time after time?—Yes.

3615. That is to say, those people who live close by?—Yes.

3616. What land do they put it on?—I think that it is used for mangel wurzel and cabbages.

3617. Do they mix it with manure?—They mix it with earth, I think.

3618. (*Mr. Harrison.*) We have been told that in the lower part of the town the sewage is carried away by the watercloset system, but that in the upper part there is a difficulty in that respect, and that the cesspool system is continued. How are those cesspools cleaned out?—The houses have only lately been built. The cesspools are temporary. We are in hopes that we shall soon be able to connect them and to dispose of the sewage without any cesspools.

3619. Do you know any instances in your district where these cesspools have become a nuisance?—Not at the present time.

3620. In past times have they become a nuisance?—Yes.

3621. What steps have you taken to do away with the nuisance?—If any nuisance arises the parties are ordered to clean them out, and they generally attend to the order. It should then be taken away in a cart.

3622. Have you attended to the supply of water to the cottages in Tottenham?—Yes.

3623. Does that come under your inspection?—Yes.

3624. Is the supply a constant one or an intermittent supply?—In the summer time we have not had sufficient water to keep it on all the day, and therefore it has been on for so many hours in the day; but many of these little cottages have no means of catching the water for their use, because they have no cistern.

3625. Is it under your direction as turncock that the water is supplied to them?—Yes, I turn it on in the morning till 8 o'clock at night if the water will last out. If not, it is turned off and is conveyed to another part of the parish during the summer time.

3626. How long do you allow it to remain on when you are short of water?—We keep it on as long as we can, several hours a day.

3627. Do you know how much water that will allow the different people to obtain?—No, but I should consider that there is enough for their use when I turn it about.

3628. Have you examined the different houses to see what means they have of storing water?—Yes, I know pretty well what they have. All the new houses have cisterns, and the old houses have what is called the high pressure.

3629. And the constant system?—It was intended for a constant supply.

3630. Do you examine the tanks into which the water passes?—Yes, I have done so.

3631. Do they attend to cleaning them out?—There is a red sediment in the water, which you will occasionally see at the bottom of the cistern.

3632. Are there overflow pipes from those tanks?—No, we do not wish them to have overflow pipes, because we might pump day and night if we had water, and it would be running away.

3633. There are ball-cocks?—Yes.

3634. And you think that there should not be any overflow pipes?—According to the present regulation there should not be.

3635. When the system is constant it is not a constantly flowing system, but a tap which gives out the water can be turned where the parties like to turn it?—Yes, and there is a great waste.

3636. (*Chairman.*) Is any water sold for trade purposes to the india-rubber works, or any other works?—No, the india-rubber works I think have their own supply, but we supply some for garden purposes.

3637. Is there any inspection of the leaking taps and pipes?—Yes, the board have lately engaged a young man to attend to that matter, to inspect the taps and pipes, and to report to them as to the waste.

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3638. And to repair them?—We call upon the owners to repair.

3639. What kind of taps and pipes are used?—They formerly used the screw-down taps and the galvanized iron, but it is now a leaden pipe, and a common water tap with a plug.

3640. Then you have done away with the screw-down tap?—There was not the pressure from the cistern. (*The witness produced some taps and specimens of pipe.*)

(*Witness.*) I prefer the screw-down tap, the plugs are apt to leak.

3641. (*Mr. Harrison.*) Since you have had the watercloset system established in your parish, have you had some severe frosts?—Yes.

3642. What is your experience as to the working of the waterclosets in the poorhouses during frosty weather?—Many people used to leave their taps to dribble a little to prevent the water from freezing but if it was shut off, most likely the pipe would burst round the tap.

3643. Have you found that if that precaution is taken the watercloset system, even in the poorest tenements, works well?—Yes.

3644. (*Chairman.*) When you used the galvanized iron connecting pipes, what action set up, did they choke up with this red matter, or did they rust away?—They choked up; many galvanized pipes I have found entirely choked up so that they could not get any water.

3645. Why do you use brass connexions, are they preferable to the wrought-iron?—It was Mr. Marshall's order, I like the galvanized iron best; it is most convenient.

3646. (*Professor Way.*) I suppose that you have frequent opportunities of seeing the precipitating works?—Yes.

3647. And the outfall into the river?—Yes.

3648. Is the outfall far from the works?—No.

3649. How far is it?—I should think that it might be 100 yards.

3650. In what state is the river at that outfall, and just below it?—The river is bad all through.

3651. Is there any milkiness, or excessive filthiness, at the position of that outfall?—It is rather white from the lime which we use. The river altogether is very bad.

3652. The discharge is white?—Yes.

3653. Is it generally so?—During the day when we are using the lime it is rather white, in the afternoon we do not consider the water much different from other water; there is not a great deal to do in the afternoon part of the day.

3654. Do you not put in any lime in the afternoon?—Yes, there is a man there to put in what is wanted, but the water in the afternoon is clear; we consider our work to be from 9 to 3.

3655. When there is most going into the sewers?—Yes.

3656. But still at times, if not frequently, the water does run away white from the addition of the lime?—Yes, it is a little coloured.

3657. Who superintends the addition of the lime?—It is ordered to be sent down when the men want it.

3658. I mean the addition of it to the sewer?—The man who stands at the works.

3659. He is under the directions of Mr. Marshall?—Yes.

3660. And not under yours?—If anything was wanted when I was there, I should have to name it to Mr. Marshall.

3661. This lime is thrown in by hand?—Yes.

3662. How often does the man throw it in?—I cannot say.

3663. Does he do it once an hour, or once in half an hour?—Yes, less than that.

3664. (*Mr. Harrison.*) Have you had any complaints made to you, or have you made any complaints about the intercepting sewer formed by the East London Water Company?—We have not had any complaint from the East London Water Company that I know of.

3665. Have you had any complaints from anyone else?—We have had a complaint from the trustees of the river Lee.

3666. Have you at any time had occasion to complain of the condition of the intercepting sewer which the East London Water Company formed?—Yes, during the summer time it was very bad.

3667. Have people residing in the neighbourhood complained of its condition?—I cannot say that people living there have complained. I have been down there, and have myself found it very bad all along through the marshes.

3668. What steps have you taken when you have found it in that state?—There was no remedy. It was an open ditch, and the drains were emptied in from other parishes, there was no way of altering it. I understand that the East London Water Company made it for the accommodation of the neighbouring parishes.

3669. Under an Act of Parliament?—Under an Act of Parliament.

3670. (*Chairman.*) Do you know whether the people were supplied with plenty of water before the board of health came here, or not?—I used to live in Marsh Lane myself, and there was a well there which flowed, but after I had been here a few years it stopped flowing, and I had to put a pump down the bore-hole.

3671. Before the operations of the board of health the people had wells and also cesspools?—Yes.

3672. And the cesspools and the wells were sunk into the same soil?—I should consider so myself, from now and then our finding a bored well, but the surface wells would have been in the gravel.

3673. And the cesspools must have been in the gravel?—Yes.

3674. (*Professor Way.*) Have you heard many regrets at the introduction of the officers of the board of health?—I think that a good many would speak very highly of it, because I have heard them say that when they went to the common closets, they never got sweet during the day and that their clothes smelt; whereas now they can go in and out with comfort.

3675. You do not think that the inhabitants of Tottenham at large seem to have the objection which the gentleman at the end of the table seems to have to the water supply?—I cannot say. I think that they are generally satisfied.

3676. (*Chairman.*) Have you anything further to offer to the Commissioners?—No.

The witness withdrew.

Mr. Peter P. Marshall, C.E., further examined.

Mr. P. P. Marshall, C.E.

3677. (*Chairman.*) You used wrought iron pipes in the first instance for your domestic supply?—That was the system when I came here.

3678. This ochrey water appears to have acted very injuriously, both externally and internally, upon those pipes?—Yes.

3679. Have you any idea what was the length of life of a pipe under those conditions?—Many of those pipes which you see here had been in about six or seven years, and some of them longer; but after they had been in about six or seven years I should think that they were in a state in which they were incapable of conveying the water.

3680. Were they eaten and perforated as the one is which I hold in my hand?—Yes, and much worse than that.

3681. Then a great proportion of your leakage and loss of water may have come from the defective state of the supply pipes?—Yes; that I have reported to the board upon several occasions.

3682. Have you removed the whole of these services?—No; our attention has generally been called to the pipes by the people ceasing to get a supply from them, and we found that the ochrey deposit filled up the pipe entirely, so that in some places no water could come through, and when the pipe was pulled out to be opened we found holes in it, and that it had decayed away. In other instances we found the supply disappeared, and we found that the water had passed away through a hole in the pipe into the gravel, and of course the gravel itself destroys the pipes. On the outside we found that the galvanizing process had no effect at all in preserving them.

3683. The galvanizing was so much waste?—Yes.

3684. Does the gravel act equally injuriously upon the cast-iron main?—No, it does not seem to affect the cast-iron mains at all. There is the operation of scaling on the surface, but not anything like the effect which is produced upon the wrought iron. We find the deposit in the cast-iron main the same as in the wrought-iron pipe.

3685. (*Professor Way.*) Did it act upon the pipes which were galvanized or not?—Yes, I think that those which were galvanized were rather worse.

3686. (*Mr. Harrison.*) Is there free acid in this ochrey water?—We had it analysed the other day, and I do not think that there is any acid referred to in the analysis.

3687. (*Professor Way.*) Except carbonic acid which keeps the iron in solution?—Yes.

3688. (*Chairman.*) What do you now use for your house services?—Lead. We compel every person to use lead of a certain weight.

3689. Do you know what is the relative cost of a house service made with iron and of one made with lead?—I understand that the price of a lead pipe of good quality and of proper weight, such as we specify it must be, is about 1*s.* 9*d.* a yard. That is ¾-inch pipe, and I understand that the same in wrought iron would cost about 1*s.* per yard.

3690. The wrought iron would have no value when it was taken out as an old pipe, but the lead would have considerable value as old lead?—Yes; the lead when it is taken out is comparatively as good as when it was put in.

3691. Is the lead at all injuriously acted upon externally or internally by this ochrey water?—I have made some inquiries into that subject. Before we supplied the district, they supplied themselves with this ochrey water, and in the district old lead pipes have been taken up which must have been in for 50 or 60 years, and apparently they have not been damaged.

3692. Then this is a district in which wrought iron services are impractible, and you are compelled to resort to lead?—Yes.

3693. As the cheapest and the most enduring?—Yes, and the water has no action upon lead.

3694. It does not dissolve it?—No.

3695. Have you a person whose duty it is to inspect house services, and to see whether the taps are left on or are in a leaking condition?—Yes, we have a man appointed for the purpose, whose duty it is to go from house to house and ascertain the state of the water supply.

3696. Have you found any diminution in the volume of water taken from you in consequence of those inspections and those operations generally?—I cannot say that it has made any perceptible difference, owing naturally to the fact that there is great difficulty in proceeding against the people.

3697. If you are pumping in the volume which you name do not you feel certain that a great proportion of that water is going to waste?—Yes, I feel quite satisfied of it.

3698. And does not every gallon wasted represent so much fuel wasted?—Yes.

3699. And working expenses wasted?—Yes.

3700. Do you not think that it would be very advisable, if practicable, to diminish that waste by proper supervision?—Yes. I attribute a great quantity of the waste to the existence of these galvanized mains, which exist to a great extent. I think that the annual saving which would result from taking up the whole of them and having proper mains put down in their place would more than compensate the cost.

3701. (*Mr. Harrison.*) Does it not affect the supply to the people as well as the expense to the board?—It does, and in places where leakage has taken place, that is the way that our attention has been brought to it. We find on examination that the pipe does not deliver the proper quantity of water, and that it is incapable of doing so.

3702. It more or less affects the people where these wrought-iron pipes are laid?—Yes; and the whole of this district has been more or less laid on with them.

3703. Could you give us some exact information as to the volume of water taken by the inhabitants?—Yes; I am preparing to give you a statement of the quantity delivered. We can only ascertain it by calculating the quantity delivered and the number of people whom we supply.

3704. In your case you cannot rely upon any calculation of the sort, because your leakage in many places is much more than your delivery?—Yes; but from the returns which I have had from many other towns they seem to have the same result; they supply as much water as we do per head, and in some places more.

3705. (*Chairman.*) Are you supplying any water for trade purposes?—Hardly any.

3706. Do you supply any of your customers by meter?—None at all. We found that the ochrey deposit prevented the meters which were in use from revolving and measuring correctly.

3707. (*Mr. Harrison.*) So that this ochrey water which you take the trouble of pumping appears to be a very doubtful source of supply; in the first instance, in consequence of the pollution in Edmonton, as well as in Tottenham itself, and after you have taken the trouble to pump it, it eats away your pipes, and it seems that after your putting in meters to measure what you deliver in some cases it partially stops the supply to the people, and in some cases stops it altogether?—Yes; you are talking of the gravel water.

3708. Yes, it is the gravel water which does the mischief?—Yes.

3709. And if the gravel water were taken by itself it would do more mischief than it does now?—Yes, and in the first instance we had scarcely anything but the gravel water.

The witness withdrew.

EDWARD THOMAS BUSK, Esq. (Edmonton), examined.

E. T. Busk, Esq.

3710. (*Chairman.*) Where do you reside?—I live in the parish of Edmonton, near Winchmore Hill.

3711. Are you chairman of the local board of health of Edmonton?—Yes, and I have been so since its formation.

3712. And are you a local magistrate?—I am.

3713. And also a barrister-at-law?—I am.

3714. How long has the Local Government Act been in force in Edmonton?—Since 1850.

3715. Have you carried out works of sewerage and water supply in Edmonton?—Partially, where required.

3716. Have you had any difficulties with your sewage recently, or at any time?—Not from our own water, only from the Colney Hatch Asylum.

3717. Do the Colney Hatch people drain or sewer into your district?—Yes; I should also explain that I am one of the visiting justices of the asylum, and we have now taken proceedings against that body, so that in my capacity as chairman of the board of health I have absolutely moved for an injunction against myself as one of the visiting justices at Colney Hatch, therefore I shall speak with delicacy with regard to

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anything which I may have to say with reference to that matter. At the same time I am bound to say that there is a very great nuisance arising from that source, or we should not have gone to law to attempt to prevent it.

3718. What population is there at the Colney Hatch Asylum?—About 2,400; there are about 2,000 patients, and about 400 attendants.

3719. Do they keep any stock of any sort, such as pigs or cows?—There had been about 30 cows at the farmstead until the outbreak a year ago of the cattle plague, and then the number was reduced to eight, and they are now increasing them again.

3720. Do they keep pigs?—They keep about 200 pigs. The pigs eat the offal; the lunatics leave a vast amount of food and it is turned in fact into pork.

3721. What area of ground have you for the asylum?—Between 70 and 80 acres.

3722. Is there any possibility of getting more ground adjoining the estate?—That was partially recommended, I think, by Mr. Lawson. We applied to you to attend to it, but your engagements would not allow it, and you recommended Mr. Lawson, and as a dernier resort he recommended the use of further land, but we were not sufficiently satisfied with the use which we already made of the irrigation there, to induce us, except in the utmost necessity, to adopt the farming system.

3723. Had you to multiply irrigation upon any of the land at your disposal?—Yes, considerably.

3724. In what way did you try the irrigation?—By hydrants; the sewage was all pumped up in the first instance by steam power, and it flowed over the land by hydrants, but the quantity which was used was not sufficient to absorb anything like the whole amount of sewage which comes from that spot.

3725. What crops did you irrigate?—We irrigated principally the grass land, and it was only available for certain portions of the year when the crop was in an early stage, it would not do to put it on in a great measure when the crop was advanced.

3726. Do you grow Italian rye grass?—Yes.

3727. Are you aware that with Italian rye grass you can go on dosing the land, and that it is of advantage to irrigate the roots three or four days before you begin to cut it?—Yes, we use as much sewage as we can upon the Italian rye grass, but the crops which are grown can only take it at certain seasons of the year.

3728. How many acres have you under Italian rye grass?—Not above three or four acres.

3729. Do you still feed your cattle from it?—Yes, with the horses, and partially with the cows.

3730. You turn it into milk?—Yes; it is cut from three to five times a year, according to the season.

3731. Does not that experiment satisfy you that it would be an advantage to have a larger area of land from which to get Italian rye grass?—There is great difficulty in applying the sewage. There are only eight hours in the day when it is pumped on. The working hours of a man are but eight hours, and only during that time is he engaged in applying it to the crop, and it does not take more than half while it is being applied, and that is only one third of the whole 24 hours, so that that is only one third of the half which is used.

3732. Then the fact is that you have a material which is commercially valuable when properly applied in agriculture, but although you have utilized one third of the half, namely, one sixth, you do not feel justified in attempting to utilize the whole?—No, because the expense is very great.

3733. Do you think that the expense is greater than the result?—Yes, we feel that to be the case, but it is difficult to measure it; we have a great deal of labour.

3734. (*Professor Way.*) Is the sewage all pumped by hand power?—It is all pumped by steam power.

3735. (*Chairman.*) You have placed your patients at Colney Hatch, and I assume that the asylum is a county asylum?—It is.

3736. Is it for a single county?—It is for a part of the county, one establishment is at Hanwell and the other at Colney Hatch.

3737. And all the expenses are met by a county rate?—By a lunatic rate, and collected at the same time as the county rate.

3738. Do you not think that it will become the duty of the magistrates to utilize this sewage, if it disinfects it at the same time, although it may not be a profitable operation, and you may be compelled to face an extra expense?—That is why we have gone to the Court of Chancery, to see whether we cannot prevent their putting any of their sewage into our brook.

3739. You are now speaking as chairman of the Edmonton local board?—Yes.

3740. And you say as chairman of the local board that your local board have gone to the Court of Chancery to restrain the magistrates from passing the sewage from the asylum down into your brook?—Exactly so.

3741. They may do what they like with it, if they will not put it there?—Certainly. We took a similar proceeding against another neighbour, our northern neighbour, Enfield. Some few years ago we obtained an injunction against them to prevent their passing any of their sewage into the Edmonton brook, and in consequence, they had to make a lateral pipe drain from west to east into the intercepting brook belonging to the East London Waterworks Company, which you have already heard about.

3742. Are there many cesspits or cesspools in Edmonton?—The system is by cesspools. We have to do only with the overflow from the cesspools.

3743. Then you are satisfied as a local board to accept the arrangement of cesspools and to arrange your drainage for taking away the surplus water, or overflow from those cesspools?—Yes, having the constant surveillance of all the cesspools, to see that they are properly emptied at regular times, and that no evil arises from them. That is our system, and I will go to results. We find that our health is nearly equal, if not quite equal, to that of our neighbours, both north and south, namely, on the north, Enfield, and on the south, Tottenham. The death rate also, I believe, is rather inferior to that of either of those parishes.

3744. Did you hear the remarks with regard to the death rate of Tottenham, that it is unduly increased by numbers of children sent in to be nursed from London?—I heard that observation made by the chairman of the Tottenham board, and I must confess that I was not prepared to hear it, because though there are several cases of that sort, and although as chairman of the board of guardians, I hear a good deal of these illegitimate children, I should not have thought that there had been a sufficient influx of that class to affect the death rate materially. I think that I can say positively that that cause does not exist in our parish, which is only two or three miles from Tottenham.

3745. From your knowledge as chairman of the board of guardians you do not think that that fact is of sufficient importance to influence very materially the death rate at Tottenham?—Certainly not in our parish. I would rather confine myself to that than to speak of Tottenham. The chairman of the Tottenham board may be right, but I was astonished to hear it.

3746. What mode of water supply have you in Edmonton?—Two sources, one from the New River, there being a main from the river at the upper part of the parish at Bush Hill, which supplies what we call the lower, but which is really the upper part of the parish of Edmonton, and also a system of separate wells.

3747. Are the wells deep wells?—They are principally, or I should say entirely from the gravel. There are a few artesian wells which are sunk very low for a constant flow of water, but the major part of the wells are from a gravelly subsoil.

3748. Do they produce this red ochrey water which we have heard of?—No, I am not aware in my own experience that it exists materially in the wells, but I know that it does exist on the surface of the soil, and

injuriously, for agricultural purposes. It has a curious tendency to stop up the earthen pipes which we use in agriculture for land draining. I have several places which I have drained, and every four or five years the pipe gets stopped up with this glutinous sort of ochrey water, which as it flows down seems perfectly pure and clear, but it contains a colouring matter which gives the water a ferruginous appearance. Forty years ago my father had this water analysed, thinking that there might be a chalybeate in it. The analysis was then conducted by Godfrey and Cook, of Southampton Row, but they could find no iron in the water. This was water taken from comparatively the surface, it being one or two feet deep. I cannot say from what that bright colouring matter was brought.

3749. (*Professor Way.*) The water frequently comes out colourless, and forms this deposit, and then runs away colourless?—Yes.

3750. You would find the iron in the first instance, but not in the last?—We had a spring which we thought chalybeate.

3751. The water deposits the iron as it flows?—It may be so; I am not a chemist, and I merely tell you the practical result of what I have noticed. I should also state that when the board was first established, we thought that the flushing system would not suit a parish of our description. We have a surface of very nearly 8,000 acres to deal with, and we thought that any thorough system of drainage was not applicable to a parish, the population of which was scattered over so large a surface as ours was; it would have been ruinous to have attempted such a system. This proceeding has been found to answer remarkably well, and it suits the pocket still better, for our rates have never exceeded 10*d.* to 1*s.* in the pound. In Tottenham they are 3*s.* 4*d.* in the pound. As a Justice I have to sign all the summonses, and in Tottenham the proportion is very much greater than in Edmonton. We don't oppose a thorough system of drainage where you have your houses sufficiently concentrated, but we are spread over a large surface, and it would not do in our parish to put a large main drain throughout the whole of it.

3752. (*Chairman.*) At the Colney Hatch asylum was there at any time a swallow hole or an absorbing well to drain into?—Yes.

3753. Did the magistrates consult Mr. Bailey Denton as to their sewerage?—No, it was Mr. Blencairn.

3754. Have you thought over the question of one body having one jurisdiction over the entire valley of the Lee, so as to enable local authorities to get rid of nuisances without all this private litigation?—I have thought it over many times, and I think that there is no other way of getting out of the difficulty, because there is no legal power at present to compel the parishes who are affected by the nuisance to unite, unless they voluntarily do it, but I do not think that there is any chance of their doing so. I am speaking of the main drain through the Lee valley.

3755. I suppose that you know sufficient of human nature to know that a permissive power, letting persons stay out or come in, might defeat the object in view?—That is my opinion.

3756. And that, however beneficial the scheme, it is hardly likely that all parties will acquiesce in it?—I certainly do not see much prospect of it.

3757. Are you sufficiently near the river Lee to be liable to be charged with polluting it?—Yes; the old river Lee is our eastern boundary, and the navigation river, which is taken out of it, runs through the eastern part of the parish. I have a considerable portion of land immediately on the banks of the Lee; but, as I have already stated, our own sewer and that of the Colney Hatch asylum do not at all affect that portion of the river Lee, because they go into the Catchwater Dyke, which was dug under an Act of Parliament passed, I think, in 1853—the East London Waterworks Act. It was constructed to catch all the sewage which was emptying itself from the western side of the Lee, and to carry it down into this parish of Tottenham, and the outfall of that Catchwater Dyke happens to be in the lower part of the parish of Tottenham.

3758. (*Professor Way.*) Do not the people of Tottenham complain of its passing through the parish?—It begins in Ponder's End, which is in Enfield parish; it comes through the whole of Edmonton parish, immediately parallel and contiguous to the Great Eastern Railway, and diverges from it at the Angel Road Station. There it takes an eastern direction, and then again flows to the south, and empties itself into the river near the mills at Tottenham. But I have never been aware of any nuisance which existed there. At the outfall there may be a nuisance, but where it flows I have never been aware of any nuisance, neither have I heard the railway authorities or the gentleman who has been for many years at the station, and lives on the bank of the Catchwater Dyke, say that there has been any disagreeable smell from it.

3759. Is that in Edmonton?—That is in Edmonton parish.

3760. I suppose that it gets worse as it flows, and is worse when it comes down here?—Yes, partially so. My own opinion is, that if the parish of Tottenham. instead of draining into the river Lee, had gone into this Catchwater Dyke, the river Lee Commissioners would not have had a leg to stand upon; but they carry their sewage direct into the river Lee, and not into the intercepting cut.

3761. (*Mr. Harrison.*) With regard to the law suit which is pending, do the Tottenham board propose to carry the sewage by a new outlet into the river Lee, or do they propose to pass it through their purifying system, and to leave it as it was to be carried to the present outfall, so that there will not be a new outfall into the river Lee?—I say that if they had taken it into the Catchwater Dyke I do not think that the river Lee commissioners could have interfered with them; that is a mere matter of opinion. It was a statutable cut made on purpose to catch the western drainage.

3762. (*Professor Way.*) That cut could not be objected to in law?—I think not. The only difficulty is that the word "now" is introduced into that statute and there is thought to be a difficulty from that word "now." It is the Act of the East London Waterworks Company, and they have never made use of it. The word "now" refers to 1853. Some legal mind seems to apprehend that difficulty.

3763. Are you not talking of a dry matter of law?—Yes.

3764. The evil would be the same whether the sewage went into the one cut or the other?—Yes, the evil would exist without doubt, and an evil it is.

3765. I suppose that we are all interested in getting rid of the fact, and not supporting these evils?—Yes, I do not see how the evil is to be got rid of except by continuing this intercepting sewer. Ware is now the greatest nuisance to the river because the whole of the sewage of the town of Ware, which has a considerable population, runs unmixed and undiluted into the river Lee.

3766. (*Chairman.*) Then if the river Lee trustees do not choose to make fish of one and flesh of the other they must forthwith commence action against the town of Ware?—Yes. The sewage of Hertford is already purified by the New River Company, but the New River Company take their source of water supply above the place where they have brought it down. After that purification they allow it to run along an open conduit for a mile or a mile and a half before it runs into the river Lee. It goes through a preparation of lime, and the works are very elaborate and very expensive; it takes the smell away, but they have a great difficulty in getting rid of their deposit as they have at Tottenham.

3767. It is not quite so valuable as guano?—Certainly not. The late chairman of the New River Company took a lot of it to his farm, which is a few miles distant, but he did not come another year for it. I am not a chemist, but in my opinion when the sewage is disinfected by lime the fertilizing quality of the sewage is very much taken away, it is deterio-

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rated. I will not say that it is wholly absorbed or destroyed, but it is very much deteriorated.

3768. (*Professor Way.*) It is not the lime which takes the value away, but the value goes away in the water?—That I will not undertake to say, but it is taken away from the deposit.

3769. You say that you have thought of the advisability of having some measure for the whole of this valley; would Mr. Marshall's scheme be such a measure; would not it be a partial dealing with works without accomplishing a benefit to the whole valley?—It certainly would. You leave Ware out and Hertford and Bishop Stortford. Bishop Stortford is on the river Stort, which empties itself into the river Lee at Rye House.

3770. If it was subsequently found necessary to deal with the upper parts of the valley, might it not be very difficult to make them fit on to this scheme?—I do not know that it would be. I think that the only way in which we can get rid of our sewage will be by taking it to the low level sewer of the Metropolitan Board of Works. I should also state that we cannot get any water supply from the river Lee, because the New River Company and the East London Waterworks Company have by an agreement taken the whole surplus water, which they want for supplying London, and therefore they would not grant it to any interlying parish for water supply.

3771. (*Mr. Harrison.*) Is not their power under an Act of Parliament?—Yes, there is an agreement. The New River Company supply themselves higher up above Ware, and the East London Waterworks Company supply themselves from Tottenham by Tottenham Mills.

3772. How are you supplied with water at Colney Hatch?—By a well which is sunk down about 160 feet into the chalk.

3773. How do you pay the New River Company for the supply which you take at Edmonton?—That is paid for by the different householders who take it according to the size of the house.

3774. Is it the New River Company's system of supply?—Yes; we have nothing to do with it; it is between the customer and the New River Company.

3775. Then the charge for water supply is not one of the rates included by you in the shilling?—Certainly not.

3776. What steps do you take at Edmonton for removing the matter from the cesspits?—Notice is given to the occupier or to the owner where there are poor cottages. The only difficulty which we have found in having them emptied when full is from the want of conveyance, but we have now a conveyance for the purpose, and have a regular system to have them emptied.

3777. How is the population of Edmonton as to density, as compared with Tottenham?—I should not say that it is quite so overcrowded, but the gross population, I think, is now 10,000 as against 14,000 in Tottenham by the last census.

3778. Is the population of Edmonton scattered over a much larger area than the population of Tottenham?—It certainly is with the exception of Wood Green, which is in the parish of Tottenham. That sewage was intended to be brought into the general system, which was explained by the surveyor, but unfortunately not being allowed to do that it does not take the natural course but flows back upon our parish.

3779. In comparing the death rate of Edmonton with that of Tottenham, the relative density of the population is an element which should be taken into account. If your population is scattered over a large area as compared with theirs, you would expect that your district would be more healthy than theirs?—Yes, but the only two cases which we have had of cholera in Edmonton we have found in the outlying and the highest district. However, that is a freak of the disease which we cannot account for. If it had extended very greatly, no doubt the lower parts would have suffered as much or more.

3780. Do you know at all what quantity of water the New River Company supply per head to Edmonton?—No, but I think that they have a regular supply. I have never heard any complaint of their supply where they have provided for it.

3781. You have mentioned what you consider to be the rate in Tottenham, can you give the details of that rate?—No. With respect to health I hear the accounts of illness every week, and the health rate is certainly quite equal, if not superior, in Edmonton to that of the adjoining parishes of Enfield and Tottenham.

3782. Are the people who reside in Edmonton of a superior class, taken as a whole, to those residing in Tottenham?—The labouring classes in Edmonton do not earn so much as in Tottenham, because there is a greater element of agricultural labour and less manufacturing. We have one manufacture, but it does not absorb any large number of people, they are principally agricultural labourers; some few go down as far as the Enfield Lock Works, but there are very few of them.

3783. Is there a large population of persons in the more comfortable classes of life in Edmonton?—I should say not; there is a larger proportion of lower rented houses in Edmonton than there is in Tottenham, that is to say of mere cottages.

3784. (*Professor Way.*) I suppose that in both places there are a great many persons who have business in London and who come to Edmonton and Tottenham to reside?—Yes.

3785. Are there more resident gentry in them than there would be in a purely agricultural district?—Yes, a sort of gentry. I am not aware of any real artisans in Edmonton who go backwards and forwards to London, but in Tottenham I believe there are a considerable number of that class. I should also mention (because it seems important that you should know it as a deduction was made from the statement of having the cesspools in the gravel) that our cesspools are not in gravel; the subsoil is gravel, but not till you get a considerable depth down. In all the valley there is alluvial soil for a considerable distance; then we come on to a very fine stratum of loam, varying from 10 to 15 feet deep, and then we come on to a bed of gravel, but our cesspools are not 14 or 15 feet deep, but only 3 or 4, and therefore they are not let into the stratum from which the water is taken. I will not undertake to say that it is perfectly impervious, but still it is not taken from the same stratum.

3786. (*Mr. Harrison.*) You think that the statement that the cesspools go with the gravel is a mistake?—I think so. At the asylum we have no gravel at all. We go down from the upper clay to the blue London clay, 80 feet, and we never touch the gravel, and that is only three miles west of this.

3787. Should you have any difficulty in obtaining land at Colney Hatch?—Yes, it seems to be nearly impossible. I do not think that we could get any there. There is one farm, but it belongs to Mr. Cline's trustees, and I understand that the tenant who is willing to let is not allowed to do so by the conditions of his lease; that is what I have heard, but there is no doubt difficulty in getting land.

3788. (*Chairman.*) Have you sewers for your water supply?—We have sewers wherever it is necessary.

3789. But there are cesspools?—Yes.

3790. (*Mr. Harrison.*) You say that you have a regular supply of water from the New River Company?—Yes.

3791. What becomes of it after it leaves the houses?—Some of it goes into the drains. Where required there is drainage from the cesspools, and from the house drainage, and that is carried into the intercepting sewer of the East London Waterworks Company.

3792. But for carrying away the water supply, after it has been used in the houses, have you a system of sewerage?—Yes, no doubt. We have no open ditches, it all goes into the intercepting sewer.

3793. (*Chairman.*) We shall have your surveyor before us?—Yes.

3794. Is there anything else which you wish to state?—No.

The witness withdrew.

Mr. ROBERT GOSSET (Edmonton) examined.

3795. (*Chairman.*) You are surveyor to the local board of Edmonton?—I am.

3796. How long have you been their surveyor?—Ever since the commencement, in August 1850.

3797. What do your duties consist of?—I act generally as surveyor of highways and of sewers, and also as inspector of nuisances.

3798. What occupation did you follow before accepting the appointment of surveyor to this board?—That of an auctioneer and surveyor.

3799. You were not educated as an engineer?—No.

3800. Is there any system of sewers in Edmonton?—They have carried out various short sewers since the board came into operation, they are divided into several contracts.

3801. Did you design those sewers and write the specification?—Yes, I had the doing of it all.

3802. How much money have you spent?—On the average I suppose about 400*l.* a year for that particular description of work.

3803. Have you borrowed any money to carry out your sewage works?—None whatever.

3804. Then you have no debt?—None whatever.

3805. What length of highways have you under your charge?—About 33 miles of roads; of course that does not include footpaths.

3806. Do you repair them by men employed under yourself, or by contract?—By men employed under myself.

3807. How many men do the board employ?—On the average ten.

3808. Do you know what weight of stone or gravel you use per year?—In the shape of material about 5,000 yards a year.

3809. Would that be about 4,000 or 5,000 tons?—Yes.

3810. In scraping your roads, can you sell the road-scrapings?—I could do so, but the board decline entering upon that.

3811. What becomes of them?—They are taken by any person who thinks fit to take them away.

3812. The board give them?—Yes.

3813. How many waterclosets do you think that you have in your parish?—Very few, perhaps not more than 200.

3814. What is your population?—About 10,000.

3815. What is the area of your parish?—About 8,000 acres.

3816. If you have not waterclosets, what convenience have you for the population?—Cesspits and privies—privy cesspits.

3817. And ash middens?—Yes.

3818. Do the board empty those cesspits and ash middens, or do the people themselves empty them?—The people themselves empty them.

3819. Then whatever cost they may incur in emptying their ashpits and cesspits it will not come into any general account, to be measured against the rates of the district?—Not at all.

3820. Have you any water supply?—None.

3821. How is the district supplied with water?—By wells.

3822. Then I assume that the parties have to dig their own well, and supply their own pump?—They do.

3823. And any cost of that kind comes out of the pockets of the owners of property?—It does.

3824. And that would not appear in the rates?—No.

3825. So that if the Tottenham people have sewers and drains, and have a water supply, and pay for their conveniences by rate, it would apparently be so much against the Tottenham people, and in favour of the Edmonton people?—No question of it.

3826. But if you could put down the cost of the wells and of the pumps, and of forming these privies, and of emptying them, you would come to something like the truth?—You might do so. In our parish people generally appear to approve of having a control over their own water.

3827. They approve of having their own well and their own cesspool?—Yes.

3828. Do you know what is the cost of making a cesspool and a privy?—It of course depends upon the nature of it; generally a cesspool would cost 70*s.* or 80*s.* I should imagine.

3829. What will it cost each year to empty them?—Perhaps 10*s.*

3830. (*Mr. Harrison.*) How many times are they emptied in the course of the year?—Some of them require emptying every year, but some will go two years, and more than that.

3831. What would be the rateable value of the poor tenements?—The rateable value generally of the poor tenements I should suppose would be 6*l.* or 7*l.*

3832. How much would that be in the pound for the cleansing of the cesspit?—It would amount to something like 1*s.* 3*d.* or 1*s.* 6*d.*

3833. That is to be put in addition to the ordinary rates of Edmonton, if you wish to compare the expense to which Edmonton goes with that of Tottenham?—It would appear somewhat fair to do so, though you must not take the statement in its extreme sense.

3834. (*Professor Way.*) In the one case the town pays for the whole, and in the other case each of the individuals pays for himself; the sum may be the same or more in Edmonton than in Tottenham, and yet you know nothing about it?—I quite understand the proposition.

3835. In one instance the expense becomes public and is known, and in the other it is not known?—Just so.

3836. (*Chairman.*) I suppose the fact will be that in the case of a cesspit, if the subsoil absorbs the material, it will take a longer time before it will fill?—No doubt of it.

3837. If it runs down into the gravel or the subsoil it takes a longer time to fill, and requires less emptying?—Yes.

3838. But if the well is pumping the water out of that cesspit it is relieving the cesspit at the cost of the well?—Yes.

3839. (*Mr. Harrison.*) What is the longest time for which you know of any cesspit remaining without being emptied?—I do not remember any to have remained longer than perhaps from two to three years; I am speaking from memory.

3840. And when it is emptied is there a large quantity of deposit taken from it?—Generally about an ordinary waggon load.

3841. After two or three years' collection?—Yes.

3842. Is there any liquid along with that deposit?—There is generally liquid.

3843. (*Chairman.*) As to the smell of that stuff when it is emptied, what kind of smell is it?—Very unpleasant.

3844. (*Mr. Harrison.*) Do you suppose that that waggon load represents the quantity of solid and liquid matter which has been turned into that cesspit during the two or three years?—I think so, with a very trifling absorption; I think that that would represent it generally speaking.

3845. You think that if you were to put a waggon under a single privy for two or three years, that waggon would hold the whole liquid and solid excrements of the people who use that privy?—It appears so to me as far as I have observed. I have not observed that there is any very deep saturation of the ground round about it after being emptied.

3846. (*Professor Way.*) Have not most or many of these cesspools at Edmonton overflows?—Most of them have overflows; all near our covered sewers have overflows.

3847. Then it is only a case of holding the solid?—Yes.

3848. It gets very solid?—Yes.

3849. (*Chairman.*) Is there anything which you

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wish to add?—I may say, with reference to the water, that we had a complaint some short time since of a well which we considered the worst, and Dr. Letheby's analysis showed that it was not bad.

3850. (*Mr. Harrison.*) What was your population in 1851?—There was not a great deal of difference, I think that it was about 9,000 or something over 9,000.

3851. Have you any establishment in Edmonton in connexion with the London unions for the purpose of rearing children?—There is an establishment connected with the Strand union.

3852. How many children are brought up at that establishment?—I think between 200 and 300.

3853. Is that the only one?—Yes, and none of their drainage gets into the brook; they have a tight tank which they pump.

3854. Do they use it successfully?—Yes.

The witness withdrew.

Mr. William Ironside (Enfield) examined.

Mr. W. Ironside.

3855. (*Chairman.*) What are you?—I am surveyor to the Enfield local board of health.

3856. How long have you been their surveyor?—11 years.

3857. Have they carried out any sewerage in Enfield?—Yes.

3858. Who designed and laid out the sewerage?—Mr. James Pilbrow.

3859. Do you know what the main sewers have cost?—When they were first put in they cost about 7,000*l.*

3860. What is the population of Enfield?—At the last census but one it was about 9,000, and at the last census it was not much increased, it was between 12,000 and 13,000.

3861. Has it increased since 1861?—Not a great deal, it increased very little between the two censuses; how much it has increased since I cannot say, but I think not a great deal.

3862. Is the Enfield Small Arms Factory in the district?—It is partly in Enfield.

3863. Does it come under your local board?—No, that is quite under Government.

3864. Have they any drainage?—No, so far as I know, I do not think they have; they scarcely allow us to go in to look at it.

3865. Have you any water supply in Enfield?—Yes.

3866. Where is the water obtained from?—Chiefly from an artesian well at Ponder's End.

3867. Was it designed by Mr. Pilbrow?—Yes.

3868. And are there an engine and pumps?—Yes.

3869. Do you get as much water as you require, or more than you require?—We did not get so much as we required in dry weather four or five years ago, and we have taken some land springs about 16 feet deep.

3870. Does that give you as much as you want?—At the present time we are laying out nearly 6,000*l.* additional for water supply.

3871. What kind of water is the water from the land springs?—It is a great deal harder than the water from our artesian bore.

3872. Is it ochrey?—I have never perceived it to be the same as was shown here to-day by persons from Tottenham. We have galvanized iron pipes, which have been on for 10 or 11 years, and many of them are as clean and as bright as when they were put on; at the same time a few of them in places are affected, and I can scarcely understand it; it appears to me to be from the earth where they are laid, but there are very few affected.

3873. How many houses have you drained?—I am not prepared to say.

3874. How many waterclosets are there?—I should think about as many as we have houses drained.

3875. Are there any privies?—In the parish there are, but not in the town of Enfield and the town of Ponder's End; the parish is a very wide parish, it extends almost in a straight line of eight miles.

3876. The town of Enfield proper has been sewered and drained?—Yes.

3877. And the houses have waterclosets?—Yes.

3878. And you have done away with the cesspools there?—Yes, and also in the Ponder's End district.

3879. Have they there a water supply from the waterworks?—All who choose to have it, nearly all of them have it now. In the first instance it was objected to, it not being forced, but as a landlord loses a tenant he finds that he cannot get anyone to take his house until the water is laid on.

3880. Do you think that the tenants themselves prefer a watercloset to a cesspit?—I have not the least doubt of it.

3881. What becomes of the refuse when it passes from your sewers?—Our sewers first empty themselves into some settling tanks, there are six of them, there are two sets, three in a set, and the material runs out of one into the other, and after it has run through those beds it passes through two other tanks which are 20 feet by 8 feet, by 4 feet 6, but we fill them about four feet; it passes through a filtering bed of stone and ballast, which is taken out and washed about five times a year.

3882. Do you use lime to mix with the sewage?—No.

3883. What weight of material do you get out of your settling tanks?—I should think that we take out 150 tons every three months, all the year round; that material is taken out in a wet state.

3884. Do you dry it?—No, we take it out by manual labour, and fill it into waggons, and we take out about 25 waggon loads from every tank, that is 25 waggon loads about every five or six weeks. The board will not allow it to be put on to grass land, but the parties taking it are compelled to put it on to ploughed land, and it must be put on the same day or the day after.

3885. Do you give it to them?—Yes, the board give them something to take it away.

3886. In your opinion is it beneficial?—Yes, in a small way, but not to the extent which I supposed is would be. I was never more deceived in my life.

3887. What is the total cost to the Enfield board of so disposing of that sewage?—About 70*l.* a year in round numbers, 80*l.* at any rate overpays it. The washing of the ballast is the greatest expense.

3888. What becomes of the fluid which passes away from the tanks?—It passes down a stone ware glazed pipe into the sewer which was cut by the East London Waterworks Company for the drainage of Enfield.

3889. Does it go into the Lee below where they take their water?—Yes; that is what they call the sewage ditch.

3890. What becomes of the ashes from the dwelling houses?—Several people get a living by having an old pony and cart, and they go round and collect them, and take them to the different brick fields. I believe that the people who take away the ashes generally give the lower orders a penny or two for taking away their ashes. Where there are gardens they are no doubt put on the gardens; there is no difficulty in getting rid of them.

3891. Are your main sewers ventilated?—There are a few ventilating shafts in them, but not many; we have never found anything disagreeable in them.

3892. What is the diameter of your largest sewer?—We have one brick sewer 3 feet 2 by 2 feet 2 that is at Ponder's End; it takes in the storm water from a part of that district as well; it is only about 600 feet long I think. The next largest is an 18-inch brick sewer, and there are 15-inch glazed pipe sewers, and 12-inch and 9-inch pipes; a great part of the parish is drained by 12-inch and 9-inch pipes.

3893. What are your junctions for draining the

houses, are they 6 inches or 4 inches?—We have nothing less than 6 inches.

3894. Have you any trouble with those pipes choking?—No.

3895. Or bursting?—No; we have only, I think, had two bursts in the house drainage.

3896. Have you had any chokings?—Now and then we have closets choked in the traps, but not in the pipes.

3897. Do you consider your system of sewerage perfect?—Yes, very perfect indeed.

3898. When you open down to put in a junction do you find the drains clean or otherwise?—They have generally been as clean as on the day when they were put in, and in the foulest instance with a 12-inch pipe there was not more than 3 inches of water in it.

3899. It may have got out of the line?—Yes. There is a little settlement in one place, but it gets no worse, and goes out as clean as possible.

3900. What do you do with the road scrapings?—We are very glad to give them if anyone will take them, and if not, we have horses and carts and shoot them where we can, and we sometimes sell them to the bricklayers.

3901. For sand?—Yes.

3902. Do you know what has been the total cost of your sewerage works in their entirety, and of your waterworks in their entirety; I refer to the total cost of the main sewers, not including the house drains. What is your debt for main sewers?—The debt is now about 6,000*l.* exclusive of the new additional works, or something like 13,000*l.* including the main sewers and the waterworks.

3903. Do your people grumble much at the oppression which they are under from having these works?—They did a little at first, but I do not hear much of it now.

3904. In your opinion do they think that they are any better or worse off for those works?—I am quite convinced that they are a great deal better off, and I am certain that in the case of those who have not got the water, if it is within where they can have it, the landlords cannot let their houses without it. In several places where they have been beyond the hundred feet, they have come to the board to ask to have liberty to put it on.

3905. Has your board had any difficulty lately with regard to the outlet of the sewers; have you had any threat of actions?—Some few years ago the Edmonton parish got an injunction against us for running the sewage through their parish.

3906. How was it settled?—I believe that we were obliged to alter it; it was a case which I always considered was very badly managed. I thought that we ought to have beaten them.

3907. You think that your lawyer was not quite equal to the other lawyer?—I do not consider that he was up to his work.

3908. (*Professor Way.*) What is the nature of the water which comes away after the deposit of the sewage?—After it has run through the filtering beds it looks clear enough; it has rather a strong smell at times.

3909. Does it run into the intercepting ditch?—Yes.

3910. Then you do not plead guilty to running the whole of your sewage into this intercepting ditch?—Certainly not. We take away 250 waggon-loads a year out of it.

3911. You have given us 150 tons in three months?—Yes.

3912. That would be 600 tons in the year?—Yes. We take from 50 to 60 waggon-loads out perhaps every 10 weeks.

3913. You said that you were surprised at the little efficacy which that stuff had upon the land?—I was never more surprised in my life.

3914. Are you aware that the liquid of sewage is infinitely more valuable than the solid?—When we take it away it is like slop, that is the water and the thick together.

3915. When you take away 12 tons of this material you do not suppose that if it was dried up it would make even two tons?—I do not suppose that it would.

3916. So that it is a very deceptive quantity?—Yes.

3917. That might moderate your view, and would not prove that it was of no value?—Certainly. It is of value if the cartage is not too much. When we took this sewage out the board advertised for parties to take it away, and they could not get anyone to take it away, and I took it myself. I drew it from two and a half to three miles, and I found that it cost me a great deal of money. I weighed every waggon-load which I drew up. Three tons cost me from 8*s.* to 10*s.* I do not think that there is much difference between the thick matter and the thin.

3918. What is the area of the filter-beds?—There are six filter-beds, and they are 40 feet long, 6 feet wide and 4 feet 6 deep. Then there are two filtering beds of stone, into which we put the worst matter. They are 20 feet by 8 feet by 4 feet 6, but we only fill them 4 feet.

3919. That is for a population of 10,000?—But there is not more than half of our parish drained. You may put down 6,000.

3920. (*Chairman.*) The population of Enfield town and Ponder's End is about 6,000?—It is about that; it is the largest parish which there is round London. I think that there are between 12,000 and 13,000 acres of land in it.

3921. Do you know what your rateable value is?—It has been raised; now it is 60,000*l.* odd.

3922. Has there ever been any talk locally of cutting off the town from the parish?—I have never heard of anything of the sort.

3923. You maintain the highways over the whole of the parish?—Yes.

3924. And levy a rate over the entire area?—Yes.

3925. (*Professor Way.*) Do you know the method of precipitating by lime as practised at Tottenham?—I have seen it.

3926. Which of the two methods do you like best, the straining of the liquid as you do it, or the mode which they adopt at Tottenham?—Most decidedly the straining through gravel.

3927. In neither case do you take out the valuable material?—I am quite aware of that.

3928. And in neither case do you purify the water?—No.

3929. (*Chairman.*) You clarify the water but do not purify it?—Yes; I think that the only way to purify it is by irrigation.

3930. Have you seen any irrigation works?—Yes.

3931. Where?—At Croydon.

3932. Have you ever tried irrigation in your case?—No; we have had no opportunity of doing so.

3933. Is there any land below you which you could irrigate with the sewage?—There would be some difficulty in it, but I have no doubt that it might be done at less expense than we are at in dealing with our sewage. The East London Waterworks Company are bound to find us a sewer, and they have put it in. I am quite convinced that we do not put nearly so much sewage into the river Lee as we did ten years ago.

3934. You are less sinners now than you were at that time?—Decidedly; when all that we had consisted of cesspools and overflows, and so on.

3935. At all events whatever there is in your water when it passes away from your works it goes into the river Lee at the point where it enters?—Yes.

3936. And if there is any sewage in your water it goes in?—Yes.

3937. (*Professor Way.*) You say that the East London Waterworks Company were bound to give you this sewer?—Yes, by their Act of Parliament.

3938. Supposing that any action was taken would it be taken against your local board or against the

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East London Waterworks Company?—I am not competent to answer that question.

3939. (*Mr. Harrison.*) You have a right to discharge into the intercepting channel which they have formed?—Yes.

3940. And if there is any lawsuit it must go against them?—I should think so. Where our sewer discharged itself into the sewage cut there was a complaint at Ponder's End. We made a complaint to the East London Waterworks Company, and they put in some 2-feet pipes and carried it down a certain distance to do away with it.

3941. That cut was purposely made to intercept your sewage, so that it might not go into the river from which the East London Waterworks Company take their water?—Certainly.

3942. So that if you might not discharge your sewage into it it would not be doing the duty for which it was specially formed?—Certainly; it was made for the express purpose.

3943. How far is it continued up opposite to Enfield?—It is continued up to where our sewer joins it.

3944. Do the towns and villages above discharge into it?—Enfield highway discharges into it, but there are common cesspools and privies.

3945. Is Enfield highway in your parish?—Yes; and also Enfield Chace.

3946. Is it not sewered?—No; the populous part of Enfield, namely, Enfield town and Ponder's End, is sewered, but not Enfield highway or Enfield Chace.

3947. The New River passes through your town?—Yes.

3948. Is the water there very nicely kept?—Yes.

3949. And all sources of pollution are kept out of it?—Yes. I think that the New River Company are as careful of the water as they can be.

The witness withdrew.

Mr. W. Cakebread.

Mr. William Cakebread (Chipping Barnet) examined.

3950. (*Chairman.*) What is your occupation?—I am surveyor to the local board of Chipping Barnet.

3951. For what length of time have you been their surveyor?—Scarcely two years.

3952. How long is it since they adopted the Local Government Act?—Upwards of three years.

3953. What is the population of Barnet?—About 3,000 within the local district.

3954. What is the area in acres?—It is simply the town; they do not take the parish.

3955. Do you know the rateable value?—I could not state the rateable value of the town.

3956. Have you any system of sewerage there?—Not anything else than what previously existed, except that some sewers have been deepened; there has been one sewer constructed within the last year down the new road which leads to St. Albans; and 1,800 feet of surface drainage to take the water from the roads.

3957. Have the houses cesspools and privies?—The houses in Barnet consist in a great measure of small houses, and the principal part of these small houses have cesspools; pans and traps have been put in instead of the old system of cesspools to a number of houses, but the greater number of houses still use the old form of cesspool.

3958. Where does the sewage get to?—It goes in various directions.

3959. Does any of it get from the ditches into the Lee?—On the eastern side of the town the drainage passes down a number of ditches and goes to East Barnet, and of course enters the Lee.

3960. Is there any water supply?—No; there are no public waterworks; the hill is full of water.

3961. And you get it from wells and pumps?—Yes.

3962. Have there been any complaints as to the foulness of the ditches, caused by the overflowings from the cesspits and the ditches?—No serious complaints of any description.

3963. Are those ditches sweet in summer?—The local board have prevented, as far as it was in their power to prevent it, the stench from the ditches by covering them in, so as to carry the matter off by pipes.

3964. When it passes off by pipes where does the sewage go?—It passes down the different ditches, depositing this sewage, and before it reaches the water which we call East Barnet brook the water becomes quite clear.

3965. And it then passes into the river?—Yes.

3966. And it then goes down to the Londoners for them to drink?—Yes.

3967. (*Professor Way.*) Mr. Beardmore says that it goes into a catchwater; is that so?—It passes into ponds before it is sent in the direction of Colney Hatch.

3968. That catchwater delivers below the intake of the East London Waterworks?—It goes on, I believe, to Colney Hatch, and in that direction.

3969. (*Chairman.*) It goes into the same catch drain which takes the Enfield sewage, and does not go into the East London Waterworks?—I am scarcely acquainted with the progress of it.

3970. Is there any talk in your board of making sewers?—Not otherwise than they are now making; they are continually making sewers where it is necessary. Lately I have had the management of upwards of 1,500 feet of drainage.

3971. Is the place at all growing in population?—Not the town of Barnet; the district is growing, but not within the area of the local board.

3972. Then that does not affect your works?—No; there is scarcely a possibility for the old town to increase.

3973. It has grown up so that it is as tight as it can be?—There is but little land available for building in the local district.

The witness withdrew.

Mr. C. Baxter.

Mr. Charles Baxter (East Barnet) examined.

3974. (*Chairman.*) What are you?—I am simply a member of the Nuisance Removal Committee, under the Nuisance Removal Act of 1855. Our parish of East Barnet is very small; we have no local board or authority of any kind whatever.

3975. What is the population of East Barnet?—At the last census it was below 900.

3976. Have you any cesspits or cesspools, or privies, or drains of any kind in the place?—The majority of the old part of the parish has cesspools.

3977. Do they overflow out into ditches?—The overflow goes into ditches.

3978. Does any of it get down into the streams of the district?—Yes, it gets down into the stream which the Commissioners have heard alluded to over and over again.

3979. And into the intercepting drain?—And into the intercepting drain in Angel Lane.

3980. What duties do the Nuisance Committee perform?—They are to inspect the cesspools or any yard or place which is likely to be a nuisance, and to see that their inspector carries out their instructions.

3981. Have you power to pay an inspector?—Yes.

3982. Have you a surveyor?—Not otherwise than the inspector.

3983. The same person fills both offices?—Yes; we have no power to borrow money for improvements or drains, we have only power to value the property

which we consider requires drainage, and by the Act of Parliament we can only levy a rate of 1*s.* in the pound upon that property, so that it is scarcely possible to make any drainage with that money.

3984. Have your board looked at the new Act of Parliament which was passed in the last session, giving enlarged powers to Nuisance Committees?—Yes, and the parish have taken it in hand; they have formed a board as they think in accordance with the Act.

3985. Has there been any complaint to your board of the ditches, as to the outfall of the sewers, or otherwise?—Not particularly in that respect. There is a strong complaint of fouling the stream in consequence of the considerable sewers which are in operation, over which our present committee has no authority. There is what we call a new part of East Barnet, which is increasing very rapidly. It is on the extreme west, adjoining Chipping Barnet. It is under the British Land Company; they bought an estate there, and they have laid it out, and an immense quantity of houses have been put up, and it is sewered. That portion of East Barnet is sewered very perfectly, and there is a good quantity of water upon it from an artesian well.

3986. Where does your outlet water go to?—Into this stream. They have four sewers discharging into this stream, and in one or two of them they have made great attempts to purify the sewage by the absorbing wells. They first bored one 300 feet, and now they have sunk one of four feet diameter.

3987. Did they sink it into the chalk?—No, but into the green sand.

3988. I suppose that you do not question what becomes of the sewage so long as it goes away?—Our only doubt is whether it will go away.

3989. You will be quite content to send it that way, if it will go away?—We shall be quite content with an outlet somewhere.

3990. It would not be an outlet, but it would be an inlet?—It would be a question whether it would go to our parish if it were so many feet deep.

3991. Is there any agricultural land near the outlet of your drain where the sewage could be put on?—Not without great difficulty, and not without great expense. I have made an attempt to put it over land, but the fact is, that nearly all our land is ornamental land, residential estates, and gentlemen's property, and it is very valuable for that purpose, and unless it was purchased right out at a great cost we should not be able to turn the sewage over it.

3992. At what does land now sell?—It is as high as 300*l.* an acre.

3993. For building purposes?—Yes.

3994. What did the British Land Company give for their land?—It is some years since they purchased it. It was contemporaneously with the establishment of the Great Northern Railway.

3995. How many acres have they?—I should think, at a rough guess, 300; it is quite as much as that.

3996. What number of houses have they put on?—There are over 500 houses in our parish.

3997. That would represent a population of 2,000 people?—I daresay that it is that number now. It has considerably increased since the last census.

3998. Then they manage themselves, drain themselves, and give themselves a supply of water?—Yes, and a very good supply of water indeed.

3999. Have they a committee in the shape of a local board to carry it out?—No, they carry it out independently, and sell their land so as to cover the expense.

4000. Are they within your area; have you power to rate them for anything?—No, we have no power to rate any person, except in the case of houses which we improve by drainage, and then only to the extent of 1*s.* in the pound per annum.

4001. And they must add some nuisance which you can complain of legally in order for you to interfere?—Yes; we had occasion to complain of their sewage last year, and we used that authority, and without taking any legal steps. We represented to them the desirability of cutting off their sewage some 40 yards before it passed this brook, and they passed it through burnt ballast at our representation.

4002. They strained the solids out of it?—Yes.

4003. Does that go on now?—Yes, at all the mouths of their sewers, excepting at the absorbing well.

4004. (*Mr. Harrison.*) Do they sell the land upon which these houses have been built?—Yes.

4005. How much per square yard do they get for the land when they sell it for building purposes?—I could not exactly state that; very small plots were sold for 50*l.* at the last sale which they had.

4006. What would be the size of one of those plots?—Perhaps three times as large as this room. I am speaking very much at sea in that respect. It is not my forte at all.

4007. What is the agricultural value of land in the neighbourhood?—I may take it at two guineas just in our immediate neighbourhood. It is cold, stiff clay.

4008. (*Professor Way.*) What number of people do you say would drain into these absorbing wells?—Into that one sewer, where the absorbing well is, there would perhaps not be more than 50 houses.

4009. That is 200 people?—Yes.

4010. Supposing the principle to be carried out do you know that the drainage, so draining into those wells, would go through some porous beds of some kind if they succeeded at all?—If they succeeded at all it would.

4011. And those porous beds in all probability would be the beds where water would be obtained from deep wells?—Exactly so.

4012. So that for the sake of carrying off the sewage of 200 people the drinking water of 2,000 people or more might be poisoned?—It does not appear that that is at all likely, for it does not answer at all; it was tried at the Colney Hatch Asylum, and I believe that it is a failure in both cases.

4013. Presuming it to be successful do you, as a person knowing how water supply is carried out for a population, think that that is a proper system?—Hardly.

4014. Supposing it to be carried out, where would the wells be?—The water I think would not be so pure.

4015. Do you not think that it is a system to be reprehended by every possible means?—I think so.

The witness withdrew.

Mr. Joseph Gilbert Blair Marshall, M.A. (West Ham), examined.

4016. (*Chairman.*) You are engineer to the local board of West Ham?—Yes.

4017. How long have you been their engineer?—About seven years.

4018. Do you remember the area of the district?—I do not at this moment remember it exactly, but it has been so often ascertained and published that it is a notorious fact; it is about five miles long by four miles wide in round figures.

4019. West Ham has been sewered?—It has.

4020. Where is the outlet?—Near Bow Creek, on the river Lee.

4021. What is the population of West Ham?—I should think that it is at present some 60,000.

4022. What is the number of houses which you have drained?—We have drained about 8,000 houses, out of the whole number of 10,000 to 11,000.

4023. In draining those houses have you substituted waterclosets for open privies?—In every case.

4024. Have you much trouble in managing those waterclosets to keep them clean?—I may say none; we seldom know what trouble is in that respect.

4025. Is the water supply in the hands of a company?—Yes, we depend upon the East London Waterworks Company entirely.

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4026. Do they supply the entire district?—They do.

4027. Is there any difficulty in obtaining water from them for the supply?—I can hardly say that there is; of course there are complaints, as complaints will arise everywhere, but I do not think that the company are unreasonable; generally we have an abundant supply.

4028. Is your district growing?—Very rapidly indeed.

4029. You have plans I suppose laid before you?—Yes, every fortnight.

4030. Have you any idea of how much it has grown between 1851 and 1861, and from 1861 to the present time?—Yes. I forget it now, but I did reckon that matter a few days ago.

4031. It is growing rapidly?—Very rapidly. I may say that every fortnight we have proposals to build at least 50 houses on the average all the year round.

4032. What is your present rateable value?—It is 160,000*l.* in round figures.

4033. What is your present debt for main sewerage and other purposes?—It exceeds 100,000*l.*; I should say that it approaches to 110,000*l.* or 112,000*l.*

4034. Some of that would be for private improvements, for street formation?—Yes.

4035. Do you know how much out of that sum is for street forming?—Probably 20,000*l.*

4036. Those would be private improvements?—Yes, recoverable from owners of property.

4037. Then your main debt is upon the sewerage?—Yes, that is the ratepayers, main debt.

4038. A great portion of the sewage I believe is pumped into the Lee?—We do pump a great deal, but at the same time not the greatest quantity; we also discharge by gravitation.

4039. About what does that pumping cost you a year?—About 1,000*l.* a year in round figures.

4040. Have you tried irrigation upon any portion of the land in your possession?—Only upon an experimental scale; we have a portion of land adjoining the pumping station, where we have made some experiments.

4041. On what area?—About an acre.

4042. What result did you get from the irrigation of that acre?—In rye grass we produced five most abundant crops, some of which we converted into hay with bad results.

4043. Was the weather against you during the time that you were making the experiment?—Yes, three crops out of the five would be incapable of conversion into hay in consequence of the uncertainty of the season.

4044. What impression has that experiment left upon your mind with regard to irrigation, if you could cut your crops green and remove them and find a ready market?—The impression that the result would decidedly be profitable and most beneficial to the district, and my inference is that that is the proper thing to do with the sewage in the vicinity of London or other large towns where the crop may be immediately removed green.

4045. Do you think that if you had land enough you could dispose of your sewage in that district upon the land and not cause a nuisance?—If there was sufficient land we could dispose of every drop of the sewage in that manner. I have no hesitation in saying that if I had sufficient power and sufficient area I could convert every drop of the sewage into good wholesome food for cattle.

4046. Do you think that that area could be got adjoining your works?—It might be got, but it is more valuable for other purposes.

4047. That marsh area is especially valuable as accommodation land, is it not?—Yes.

4048. At what is that land now taken per acre?—3*l.* or 4*l.*, but it is being rapidly absorbed for commerce, and for the purposes of the City of London docks and habitations for dock people, and for ship constructors, and factories for chemicals, and all sorts of things. They are being spued out of London and across Bow Common, and they are being shot over the Lee, and they find convenient localities there; and for these purposes the land is more valuable than it would be for the growth of grass for cattle.

4049. What is your experience with regard to the mode of ventilation adopted on the the main sewers at West Ham?—I think that, practically speaking, it is perfect.

4050. Have you occasion to have some of the flatter sewers cleansed by hand at times?—We have had occasion to do so about twice in the seven years.

4051. Not more?—Not more.

4052. Do you know what the gradient of those sewers is near the pumping works?—Yes, it is very flat, one portion is horizontal.

4053. Do you find any difficulty in keeping that portion clean without manual labour?—We have never had occasion to touch it, but that is close by the pumps, and the draught is exceedingly rapid; it clears itself as clean as a whistle.

4054. Do you occasionally adopt the means which you have at many points for flushing?—Yes, but only very occasionally. We found it expedient during the last summer to wash out the sewers. I believe that we should not have had occasion to do so, except to please the people on account of the cholera. We did wash them down, there was so much sentiment in the affair that we did it to please the people.

4055. Have you had much choking?—Never with the main sewers.

4056. Do your drains much trouble you with choking?—Very seldom; it is quite an accident if a stoppage takes place.

4057. Have you had much difficulty where the sewers cross the navigable portions of the river Lee?—We have never had the slightest difficulty.

4058. Have you considered the question of the ultimate disposal of the sewage if it is to be kept out of the Lee and out of the Thames?—I have considered very carefully the subject of dealing with our sewage, that is to say our outfalls. Of course it is not at all satisfactory, though the discharge into the river Lee enters even so low down as the Thames, and we are under some degree of pressure to alter that discharge. Latterly we have been deodorizing by the application of carbolic acid and per-chloride of iron.

4059. Is it the fact that the Lee itself, supposing that you did not pass one ounce into it, is quite as foul as your sewage before you pass anything into it?—I should say that it was absolutely as foul; it looks as foul, and certainly no sensible impression is produced on the river Lee that I could ever detect, even when we are pumping into it in all times of the tide.

4060. The river Lee is a tidal river, and a large area of bank is exposed every tide?—It is so each tide.

4061. In what condition are those banks when they are so exposed?—They are covered with a slimy deposit of mud, of a most offensive appearance, and certainly with no agreeable smell.

4062. In hot weather, what kind of sensation have you, when walking near that mud?—I always have the sensation that I should like to be somewhere else.

4063. Then, before the river Lee can be made satisfactory, I suppose that it must be freed from this sewage, and something must be done to cleanse those mud banks, or to remove the mud?—Yes, or probably they would cleanse themselves.

4064. Do you think that any tidal channels of that kind ever cleanse themselves?—I question it, but I hope that they would become clean if the Thames was made clean and the upper part was made pure.

4065. Have you ever had occasion to consider the upland water of the river Lee?—Yes, it came specially under my attention.

4066. Is there a large growth of population at Silvertown?—There is an enormous population springing up there; there are some 500 people I suppose living there; there are houses for them, and large works are being built.

4067. Have you done anything for the sewerage of

Silvertown ?—Nothing; it is polluting the neighbourhood, and it is polluting the ditches.

4068. Have you had much surface flooding during these last heavy rains ?—We have had no surface flooding of any magnitude this season, but last year, after the snow, we had the region between Tottenham and Stratford and Lee Bridge covered with water.

4069. Has it been so within the last three weeks or a fortnight ?—Not to my knowledge; I am aware of several impediments on the Lee, but I am not prepared to attribute that flooding to any impediment within my knowledge.

4070. You are not the engineer of the Lee ?—No; in the district of West Ham we have scarcely any surface flooding now, in fact, I may say, none.

4071. Have you any idea how many surface gullies you have ?—We have about 1,500.

4072. They take away the water into the sewers and the sewers convey it down into the outlet ?—They do.

4073. Have you had any floodings from the sewers being too full ?—We have had a few overflows in cellars; I may say that it has never quite reached the surface of the ground.

4074. That is in some of the low cellars by Barking Road ?—Yes, we had two or three occasions on which it occurred.

4075. The surface of the ground there is some six or seven feet below high-water line ?—The surface of the ground there is 14 feet below high-water line.

4076. I think that you let all the persons who dug out the surface there, and made those cellars, do it upon their own responsibility ?—We did not let them do it; when they have dug cellars they have done it on their own responsibility.

4077. (*Mr. Harrison.*) It is of no use raising the whole district several feet, and then when you do it for different persons to dig down again; they must do it at their own risk ?—Yes.

4078. You say that London, as it were, spues out these large manufactories into the Ham marshes. What is the value of the land at Ham marsh; it is about 3*l.* an acre you have said ?—It lets for that per acre; if you went into the market to buy it you must probably pay 120*l.* an acre for the marsh land.

4079. An increased price would be put on for the prospective value which it would probably have to the buyer ?—Doubtless in consequence of its proximity to London.

4080. What is the value of the land when it is purchased for manufactories ?—It varies very much. On the banks of the river Thames, or near the navigable streams, it fetches as much as 1,500*l.* to 1,800*l.* an acre. I do not say that you could buy the land at any time near the river for 120*l.* an acre; it is not the same land as I was speaking of when I gave you that price.

4081. You mean land further away from the river ?—Yes, agricultural land, grazing ground.

4082. Supposing that manufactories were erected adjoining the river for a considerable distance below Bow Creek, what would then become the value of the Ham land within the land on which those manufactories were built ?—It would probably then be worth, for building purposes, 800*l.* to 1,000*l.* an acre, sold in plots as ordinary building land.

4083. Considering the question of your inability at Ham to obtain this land for the application of your sewage, in consequence of its increased value, it seems to point out that that land subsequently may fairly be put to a considerable expense to carry the sewage from it to a great distance off in consequence of its great increase of value ?—Doubtless.

4084. And that argument would work back into the whole of London. Any town which is so increasing that the rental is an imaginary value, so that the land cannot be obtained for irrigation purposes, may fairly be put to the expense of carrying the sewage beyond that limit to apply it to the land ?—Undoubtedly.

4085. I think that the arrangement is that your outfall at present is merely a temporary one ?—That is all.

4086. Is it understood to be a temporary one ?—It is understood to be of a temporary character; it is not a temporary structure, there is nothing temporary about it; it is a good and efficient, and is a well working, and well-constructed piece of machinery; at the same time its position and its circumstances can only be looked upon as of a temporary nature.

4087. And the actual understanding, if not arrangement, with the River Lee Navigation Company is to the effect that it is only temporary ?—In point of fact that is so. I believe that there is a written understanding between the board of health at West Ham and the river Lee authorities, that when called upon the board shall do something. I cannot exactly say what; it is impossible to say at the present time what can be done, but the understanding is that the board shall do what can be done to make things better.

4088. Have your board considered what can be done ?—They have. I have been instructed by my board to consider what can be done.

4089. What have you reported ?—In the first place I was instructed to consider whether the sewage of the district of West Ham could be disposed of by discharging it into the low-level reception place of the metropolitan board, which is in the centre of our district at the Abbey Mills, leaving it to the metropolitan board to lift our sewage and dispose of it as best they could, and we paying them such terms as could be arranged between us. In considering that subject with their engineer we came to the conclusion that that was not the best nor indeed the proper thing to do; but considering that the metropolitan board themselves were under the obligation of sewering a part of the county of Kent, which lies on the north side of the river Thames, and which includes the populous place of North Woolwich, and that they were under the obligation to provide an outfall sewer and pumping works for it, and considering that the local board of the district of West Ham were under the obligation of providing for the sewage of what we call the district of Silvertown, that is the area lying between the Victoria Docks and the river Thames, and which is not sewered, and is a sort of isolated district cut off by the Victoria Docks from the other portion of our district, and considering that the low portion of the East Ham marshes would ultimately require sewerage, we after careful consideration came to the conclusion that the right thing to do was to make a good outfall sewer straight away from our present outfall works, picking up our works there, and carrying it right down to the banks of the river Thames near Barking Creek, in fact as far down the river as the metropolitan board has gone; that we should pick up our drains at the Barking Road, and carry our works down to the banks of the Thames, and there place a pumping station, at the same time carrying a branch sewer down through our Silvertown district, through the metropolitan works in the North Woolwich district, and also giving an opportunity for the district of East Ham to drain into it, and erecting on the banks of the Thames a proper pumping station with adequate machinery to deal with the whole, on a sufficiently grand scale to meet all the requirements of the various parties whom we should thus serve.

4090. Do you mean by putting the sewage on to the land or by delivering it into the river ?—We have got to the point of lifting it, the question of what we should do when we have lifted it is a moot question. I cannot tell you what can be done, but if we can get there with our sewage we shall at least have done all that other people have been able to do, and all that anybody can tell us how to do with benefit. If we must throw the sewage into the river when we get it there we must do so; if other people must throw it into the river, so we must throw it into the river; but if other people can take it on to land, so we should have an opportunity of taking it on to land, and if other people can devise any means of utilizing it by converting it into gold dust or anything of that kind,

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then of course we should have the same opportunity of making it into gold dust.

4091. But I think that you told us that you had made an experiment on a small scale, and that the result of that experiment was that you could make it into gold dust?—My experiments undoubtedly persuade me that the right thing to do with it is to convert it into rye grass, for the nourishment of the horses and cattle of London, and of the cattle which now browse on the Essex marshes, because of course there it would be in the centre of the Essex marshes.

4092. Could you now get land at that distance down the river at a reasonable rate for the application of the sewage to it?—I think so.

4093. If so, would it be a wise thing for your board to take steps to do so at once?—I think so, but whether the board would do it is another matter. I should certainly advise them to do it.

4094. (*Chairman.*) I suppose that the board generally give you advice?—They give me more than advice.

4095. (*Mr. Harrison.*) You do not mean to say that you do not find that they are advised by you?—I very often find them indisposed to go into anything of a speculative kind, any scheme of any great magnitude; in fact they like to keep their enterprises pretty well at home.

4096. As to the occupation of a site of land at Bow Creek, does not your sewage form a considerable part of the polluted water which passes into Bow Creek?—I think not. Our sewage is discharged in two ways. The first mode is by gravitation, when the tide permits. I take it that it runs away with the tide, out into the open stream of the Thames, into a large volume of water. Then we pump. When the tide returns it very soon shuts up our discharging opportunity. It shuts up our self-acting sluices, and then we fall back upon the use of our pumps, and we use them with a little discretion as to how we shall throw the sewage into the tide, we take care as much as possible that it shall only be done when the tide is flowing out, and we calculate upon the sewage going with the river, not up the river but down.

4097. By gravitation it passes out when the tide is receding, and when the tide rising stops the outlet there is no discharge at all for a certain period?—That is so.

4098. When the tide begins to recede again after its flowing you pump so that the sewage shall go into the water when it is receding from Bow Creek?—Yes. Our sewers retain it for a certain time till the water gets up to high tide.

4099. (*Chairman.*) They form a tank?—Yes.

4100. (*Mr. Harrison.*) So that by management in that way you think that very little of the sewage from your discharge goes back up the river Lee?—Very little.

4101. Have you attended much to the supply of water to the poor tenants in West Ham?—I have had occasion very particularly to attend to it; in fact, in carrying out the drainage of the houses, which we have done very generally, in every case where we lay in a drain to a house we insist on the owner providing a tank to hold water to flush the closets, and to supply the house at the same time. We have taken advantage of the opportunity, and concurrently with the laying of the drains we have insisted upon the houses being properly supplied with water for the tenants.

4102. What sized tank can you supply?—About 3 feet by 18 inches, by 15 inches deep, or thereabouts.

4103. Upon the average how many gallons a day would it supply to the household?—From 30 to 40 gallons.

4104. Is the system at West Ham intermittent?—Yes; there is some constant supply throughout the district, but as a general rule it is intermittent. The supply is turned on in the morning, and the cisterns are filled. We trust to Providence after that.

4105. You take the supervision of the tanks of the poorer tenants, and you make it obligatory upon the owners of the property to supply such tanks as are necessary?—We have not taken the supervision, because that is in the hands of the water company who supply the water, but we have taken the opportunity of compelling owners to supply water to tenements where a water supply did not previously exist. In a great many cases we have done so.

4106. Is the power which you have exercised in that case one which you could legally enforce?—Yes. We have never exercised it unless we could legally enforce it, at least we have never in that case attempted to exercise it legally. We have exercised power in two ways. In the first place we have exercised moral power. When the owners of the property have had their drains laid in we cautioned them against having waterclosets without water supply. In many cases we could not, from the limited powers of the Act, compel them to have water, but in many other cases we have been able to compel them to have it, and in fact by the co-operation of the waterworks company, by giving us special rates, in some cases we have been able to do it.

4107. Do you think that in all cases, if the local boards in the parishes of London co-operated with the water companies, they could enforce a similar system?—From my experience I should certainly say so, by forcing and coaxing.

4108. You find that where the coaxing system will not do the forcing system answers?—Yes; but just let me point out a very important hitch here. We have found that the price fixed by the Public Health Act, namely 2*d.* a week, is too limited. We find that the waterworks company's rate exceeds 2*d.*, and when it exceeds 2*d.* we are powerless. When a supply is wanted the company decline to give it. If we cannot supply it at 4*s.* 4*d.* a half-year to the tenements, we cannot compel the owners to supply it at all; that is too low a rate.

4109. (*Chairman.*) You would have power to compel the owners of property to take the water at the company's published scale of charges?—At the authorized scale of charges, decidedly. In some cases I have been obliged to ask for a special rate to enable me to report to the board that it was within the powers of the Act.

4110. In those cases you have referred to, where there is an overflow from the tank, is there a ball tap?—No. The waterworks company object to that; they think that the people might let the water run on to waste, and they object to put an overflow.

4111. (*Professor Way.*) You are, I think, an advocate for the application of sewage to land?—Not particularly an advocate for it.

4112. You believe, do you not, that it would answer to apply sewage to land. You say that this valley cannot be kept pure unless the sewage is intercepted, which no doubt is the case, but in intercepting it, supposing you go further up the valley, I presume you would be collecting all the sewage and bringing it down to rather valuable land before it was distributed?—Lower down, it may be valuable land.

4113. And subsequently it would have to be distributed again?—Yes.

4114. Would it not be better to deal with the sewage at certain spots where you would have all the advantages of the intercepting sewer, the object being to carry the sewage from the small towns to a point where it could be concentrated, and from which it could afterwards be distributed?—I may explain that as a matter of detail, adverting to this proposition, I omitted to notice, [and I am sorry I have not got it,] the written description by Mr. Bailey Denton; but if you will refer to it you will find that the point to which you have referred has not escaped our consideration. We propose, of course, as we come down the valley, to intercept all such sewage as we can find available for irrigation, wherever we can find land to apply it to. We propose at every point to deal with the sewage as we come down the valley in the most efficient way; but we know that we must have an

ultimate outlet to take that which we cannot deal with in any other way. Anything that we can catch at a higher level up the valley and send down to the lower district, and there deal with, of course we should catch; but we know that we must have an outlet, and power to deal with that which gets to the outlet, which we cannot possibly deal with in an intercepting way.

4115. The quantity that could be so distributed is now unknown?—Quite so; and the great difficulty is to get land in suitable positions, and, again, people will not have it. It is well enough for me to be an advocate for the production of rye grass, or celery, greens, peas, and vegetables of all sorts, which I have produced, but people will not have sewage irrigation near their habitations.

4116. (*Chairman.*) And yet they will make top dressings of putrid manure, which is 20 times more offensive?—Undoubtedly; and they will leave it there reeking in the sun for days and days, whereas this stuff would go away, and it would be all settled in six hours.

4117. (*Professor Way.*) Like most other popular prejudices, do you not think this will pass away in a few years?—I hope so.

4118. Consequently, you might hope to find within reach of all these towns land for the application of their sewage without taking it down to a place from which you must discharge it into the river, or set to work on a large scale to distribute it?—Yes; I hope that condition of things will come to pass, but I should never be able to get over the necessity for a good outfall sewer, and for this reason, that however complete irrigation may be in its arrangements, and however well you may have everything fitted for irrigation, still a heavy rain will sometimes come at the rate of three quarters of an inch in three or four hours, and then the water will run down into the lower regions. Acts of Parliament will not stop gravitation, and injunctions in chancery will not stop the river Lee. The water will go down, and of course it will carry dirt out of the sewerage and out of the streams from every source into the channel of the Lee, and if we drink that water it will be nonsense to say that we can drink it with impunity and without risk; it will be dirt if you let this water go into the river Lee at all.

The witness withdrew.

The witness subsequently forwarded to the Commissioners the following Report:—

REPORT urnished by J. G. B. MARSHALL, ESQ., C.E., Engineer to the LOCAL BOARD of HEALTH at WEST HAM, upon the Sanitary Arrangements of WEST HAM.

Stratford, 18th February 1867.

The area of the district of West Ham is nearly 5,000 acres.

The population is now about 60,000.

The number of houses about 12,000.

Of these there have been drained 10,000 with waterclosets; water supply dustbins, yard pavements and surface water, roof drainage and ventilation complete.

The houses are chiefly six-roomed cottage residences of artizans and their families, many of them I am sorry to say being improperly crowded to their roofs.

The cost of drainage, providing and fitting in sink, soil-pan, dustbin, and yard paving, may be averaged at 6*l.* per house; this cost is in each case defrayed by the owners or leaseholders, or in some cases by arrangement between them.

To the question, What per-centage of chokings or stoppages has there been in house drains, sinks, and waterclosets? I can only answer, "There is no such thing here as choking;" an occasional failure may take place from bad workmanship or neglect of the principles laid down for the guidance of the men and shown on the sheet of details, one of which is issued to every person who has to put in house-drains, &c.

An inspector from my office attends and sees every pipe properly jointed, and every portion of the work completed, before it is covered up, and the reducing discussed for the closet-pans, making every pipe-drain which is beyond the reach of a man's hand 6 inches in diameter, guards against anything getting into a pipe-drain which is likely to stop it. In all cases the pipe-drains are laid with uniform inclinations from the surface to the sewers, which prevents stagnation and ultimate choking.

The recent severe frost caused no mischief or extra expense after its disappearance.

My experience here as to the relative advantages of waterclosets over privies and cesspools is not a fair general guide, because in a flat marshy district like West Ham, with a clay subsoil always saturated with water, privy cesspools cannot exist; there must be an overflow somewhere. Here I found such cesspits discharging their contents into open ditches and polluting the atmosphere frightfully; the only cure was conversion into waterclosets; simultaneously with this alteration I have filled up the ditches and introduced means of supplying water for flushing and domestic use. I have also drained all yards, sinks, and roofs, using rainwater pipes as ventilators, for which they serve admirably, and keep the drains free from gases.* It is impossible fully to describe the beneficial effect of the alteration in the premises produced by these means. In many instances the inhabitants have become of a higher grade, and health and comfort must have been greatly improved.

Of course other evils of overcrowding, uncertainty of food and clothing—human improvidence—remain unabated; and diseases still exist, but not to the same extent and virulence as before the works existed. The mortality, which was formerly very high, would now be found moderate, if not very low, in certain seasons, were *the infant mortality* not so excessive as it is.

I have now only time to give these naked facts, but any information or opinions on points constantly under my notice are quite at your service; and of course you are at perfect liberty to make any use of them, either for your own purposes or for the public good.

J. G. B. MARSHALL, M.A. and M.E.

* The whole of the main sewers in West Ham are ventilated at several 100 manholes, the gases in all cases filtering through charcoal. Down-spouts are not therefore relied on. Sewers cannot be fully ventilated by down-spouts.—R.R.

Mr. WILLIAM DELANO (Tottenham) examined.

4119. (*Chairman.*) What are you?—An agriculturist.

4120. Where do you reside?—I reside near Park station, in the parish of Tottenham.

4121. Are you officially connected with any of the local boards?—No, not with any of them.

4122. Are you a ratepayer?—Yes; I pay rates to the parish of Enfield, the parish of Edmonton, the parish of Tottenham, and the parish of Hornsey.

4123. To what particular points in connexion with this inquiry do you wish to speak?—I wish to speak upon the whole matter of the inquiry, and first upon the pollution by town sewage.

4124. Do you mean the pollution of the river Lee?—Yes.

4125. That is polluted from town sewage?—Yes, in certain places it is so, but the pollution from town sewage, I take it, is not now very great.

4126. I suppose it is a fact that all the sewage from the different towns and villages finds its way into the natural outlet of the valley by drainage?—Not of all the towns.

4127. I suppose it gets into the Lee ultimately?—Yes, ultimately; but very low down, below Tottenham. The Lee is almost a common sewer at its outfall into the Thames.

4128. Is the river Lee polluted by any other forms of refuse?—I take it that the river Lee proper would be affected a little by the towns on its margin, or at those places where the sewage of a town enters it.

4129. Have you been to Luton?—No.

4130. Have you been to Bishop Stortford?—Yes.

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4131. Have you inquired specially into the pollution of the Stort by the sewage of Bishop Stortford?—No, I have not.

4132. Nor into the pollution of the Lee at Luton?—No.

4133. Have you paid any special attention to the sewage of Hertford?—I believe it is intercepted by the works of the New River Company, and therefore there is very little matter, I take it, that comes in from Hertford; but when you come down to Ware, there I expect there is some feculent matter that comes into the river, and from other places in its course. I may say that I hope to see a water supply extended to this place. You have heard how yellow the water is, and I hope we shall have the water from the Tottenham Board Supply. If the East London Water Company will take the initiative, and make a sewer on each side, then I think there will be nothing to complain of as to contaminating the water.

4134. Where do you get your drinking water from?—From a well.

4135. Then you are not interested in a supply of water to Tottenham?—Only in the enormous expense the board will be put to in providing water.

4136. You say you have not been to Luton?—Yes.

4137. Do you know that there are many tons of poison discharged into the river there every year?—I have seen the evidence taken at Luton, and I do not understand that it is poison.

4138. What is oxalic acid?—Of course it is poison, but it depends upon the degree to which it is put in; there is such immense filtration going on down the river Lee, four or five miles below where it comes from, that it would come down here very clear indeed.

4139. Is the river Lee now polluted by sewage?—It is in certain places, from Ware, and the new towns that are being built upon the river near Waltham Abbey. On the other hand it comes down here pure and clear from the weeds; there are aquatic plants that take up all the impurities before the water comes down here.

4140. That is your opinion?—Yes.

The witness withdrew.

Mr. J. Phillips.

Mr. JOHN PHILLIPS (Tottenham) examined.

4141. (*Chairman.*) Where do you reside?—In the high road, Tottenham.

4142. You have been, I believe, a member of the local board of Tottenham?—Yes.

4143. For how many years?—About 10 years.

4144. What special points do you wish to speak to?—The state of the river Muswell.

4145. Through which part of the parish does that river flow?—It is near the centre, generally speaking.

4146. Does it receive the sewage of any portion of the parish?—Yes, of some portion at the present time.

4147. In what condition is it?—In the summer season it is in a very filthy condition indeed, both in appearance and as regards smell.

4148. Where does the outlet fall into?—In my younger time it used to be pure, or so nearly pure that I used to like to drink the water very much. My dinners were in those days frequently cooked with it, but now at times I have not been able to bear the smell of it, particularly in hot weather.

4149. What do you think causes the pollution?—Sewage.

4150. From what source?—From waterclosets.

4151. What is the name of the street or place where the houses exist from which the sewage comes?—I should apprehend that it would be from Wood Green and Tottenham, and considerably from Hornsey.

4152. Flowing down into the Muswell?—Yes.

4153. Where does it flow to?—Into the river Lee.

4154. Does it go into the Lee below where the East London Water Company take their water?—Yes.

4155. It pollutes the water of the Lee where it goes in?—Yes.

4156. Is that within the jurisdiction of the local board of Tottenham?—Not under the present state of the law as it appears to me. The river Lee trustees prevent us from connecting our new works, and the Hornsey board have not the power to alter the present state of things.

4157. Is it necessary that there should be some additional power or higher authority to deal with the question as a whole?—I think it requires some additional power. In the summer time the river I have spoken of is in places covered with a fœtid looking scum of a dark green colour, or a pea green.

4158. Are you aware that there are other streams in the valley of the Lee quite as impure?—I know that there are others very impure.

4159. But this is the most impure within your knowledge?—Just so

4160. You would naturally wish to see it dealt with so as to be rendered pure?—Yes.

The witness withdrew.

Mr. G. Ross.

Mr. GEORGE ROSS (Tottenham) examined.

4161. (*Chairman.*) You are registrar of births and deaths?—Yes.

4162. What information have you to give about the river Muswell?—Some time ago a new cemetery was formed in this parish, and that cemetery was found to be very wet indeed. Some two or three times there has been an attempt to drain it, and the drainage of the cemetery flows into the Muswell, which I cannot think of without shuddering.

4163. You believe that some of the filtration from the cemetery may find its way through the subsoil into the Muswell?—Yes, I believe it does; it is drained into the Muswell.

4164. That tends to give it the appearance and smell which the last witness spoke of?—I presume so. The cemetery is nearer this end of the Muswell than the other. If Mr. Phillips referred to this end of the Muswell it would have a tendency to do so.

(*Mr. Phillips.*) I referred to a part higher up.

4165. (*To the witness.*) How long have you been local registrar?—From the beginning, since the Act came into force.

4166. Had you known the district before the board of health was formed, and down to the present time?—Yes.

4167. Taking the parish of Tottenham, and especially the town portion of it, what is your opinion with respect to the public health before and after the local board began to act; is it better or worse?—I cannot say that there is much difference.

4168. The population, I believe, has increased very much?—Yes, I believe it has increased very much.

4169. It was an agricultural district, was it not?—Yes, and very healthy.

4170. Now it is a town district?—Yes.

4171. And thickly peopled?—In some parts it is thickly peopled.

4172. Do you consider it remains healthy now with a population so largely increased?—Yes.

4173. Have the operations of the board been beneficial or otherwise?—I do not observe much difference.

4174. Has there been much fever in the last eight or ten years?—There has been fever occasionally, more or less, in different localities now and then.

4175. Have you ever furnished a detailed statement of the mortality of Tottenham?—Yes; every month I send to the local board a detailed statement of all the deaths that have occurred, and I have done so for the last few years.

The witness withdrew.

Adjourned to to-morrow, at 10 o'clock, at Hertford.

Hertford, Wednesday, 19th December 1866.

HERTFORD.

W. M. Armstrong, Esq.

19 Dec. 1866.

PRESENT:

ROBERT RAWLINSON, ESQ., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, Esq. | Professor JOHN THOMAS WAY.

WILLIAM MATTHEW ARMSTRONG, Esq. (Hertford), examined.

4176. (*Chairman.*) You are mayor of Hertford?—Yes.

4177. Is Hertford an ancient municipal borough?—Yes, it is very ancient. I produce the ancient charters of the borough, at least copies of them; there is one of Charles II., which is the principal charter under which we are governed. I also produce abstracts of grants with reference to the commons. The first is the 3rd of Charles I., a grant of Hartam, Kingsmeads, and Little Hartam. Then there is a charter of Charles I. as to the corporation of the borough, and a charter of Charles II., which is the principal creating charter, and which embodies the whole of the powers given to us as a corporation.

4178. I suppose you have passed under the hands of municipal reformers?—Yes; the boundaries of the borough were enlarged for parliamentary purposes.

4179. Under the Reform Act?—By the Municipal Act.

4180. This is a municipal and parliamentary borough?—It is.

4181. What is the area of the municipal borough?—I do not know.

4182. Is the area of the municipal and the parliamentary borough the same?—No; the ancient municipal borough is very much smaller than the parliamentary borough.

4183. And the area of the municipal borough was fixed, I assume, at the time of the reform of municipal boroughs by the Commissioners?—Yes, those boundaries were then defined.

4184. Now the parliamentary borough is much larger than the municipal borough?—Yes.

4185. Was that fixed during the passing of the Reform Bill?—It was fixed under the Municipal Corporations Act, which was passed subsequently to the Reform Act. The present municipal borough and parliamentary borough are co-extensive now, but the limits of the ancient borough are still different.

4186. Have you adopted the Public Health Act or the Local Government Act in this borough?—No.

4187. Neither the one nor the other is in force?—No; we have Acts of Parliament, our own private Acts.

4188. Do you know what the population of the municipal borough at present is?—6,769.

4189. Has there been any increase since 1851, or is it an increasing district?—There has been an increase, though not a very extensive one.

4190. Is there any business of any kind carried on here?—The principal large trades which are carried on here are the oil mills; there are two extensive oil mills; one is situated in Hartam, the other is at the other end of the town.

4191. How are you situated with respect to the river Lee or any of its tributaries; there are some mills, I believe, in the town?—The Lee passes through the town.

4192. The river Mimram, is it not?—The Mimram and the Beane fall into the Lee.

4193. Is Hertford sewered?—It is very effectually sewered.

4194. At what date was the sewerage carried out?—Since the Act of 1854, called the New River Company's Act. The town has been most effectually sewered, and all the sewage is diverted from the Lee and passes to deodorizing beds.

4195. Were those works carried out under the arrangements set forth in the Act of Parliament which you named?—Yes, the Act of Parliament is here, and the works have been carried out under the powers of that Act.

4196. Have you a surveyor in the borough?—I do not know that we have, we have an officer who is paid by the borough as a surveyor; he is a gentleman whom we generally employ as our surveyor.

4197. Is there any person who will describe the character of those works, or will you undertake to describe what the character of them is?—No, I cannot do that. I have directed that the plans shall be produced; a plan of the sewerage, a plan of the town, and a plan of the water supply to the town.

4198. Those works were devised, I assume, for the purpose of purifying to some degree the river Lee?—Yes, and they have produced that effect most completely.

4199. Is the sewage treated chemically so as to cause a deposit of any solids, or is it applied to land for irrigation purposes?—I believe, although I do not speak from any scientific knowledge of the matter, that the sewage passes into deodorizing beds, between Hertford and Ware, and then the liquid part of it finds its way back again into the Lee, after going through the disinfecting beds.

4200. The liquid is not passed over land for irrigation?—I think not; but as to the effect of this system of diverting the sewage, I may say that the water after it passes through the town is now in a very pure state. A few months ago the corporation thought it right to analyse the waters from three different parts of the town, from the new waterworks, from the centre of the town, the hydrants, and also from the place which we call the old waterworks, which is the water after it has passed through the town. Professor Taylor, whose report will be laid before you, has analysed those three or four different portions of water, and he gives a most favourable account; the water at the old waterworks after it passes through the town is said to be, I think, as good as any water need be for a town, and that is from the river Lee itself.

4201. Have you an analysis of the effluent water that flows from the sewage tanks?—No, that does not affect us at all.

4202. Do you know anything of the sanitary arrangements of the borough?—I have directed the sanitary inspector and the superintendent of our waterworks to be here, if you think proper to examine him.

4203. Will they speak to the number of water-closets in use, or can you furnish us with that information?—I think it is very likely that our sanitary inspector can give you very satisfactory evidence on that point.

4204. Have you a public water supply in Hertford?—Yes, we have two.

4205. Do they belong to companies?—No, they are the property of the corporation. The whole supply used to come from the waterworks on the Lee, but a few years ago new waterworks were established above those, and the water is now taken principally from a well in Hartam; it is pumped up by machinery and supplied to the town.

4206. That is delivered under pressure?—Yes, there is a reservoir at the top of Port Hill, near Bengeo, to the north of the town; that is supplied from the waterworks; the water is raised to a reservoir on the top of the hill, and that is the source from which the town is supplied at high pressure.

4207. Do the corporation supply all the houses within the town, or have any parties got private wells and pumps?—There are a great many private wells and pumps in the town, but the water is supplied to those who will take it and pay for it.

4208. The waterworks are the private property of the corporation?—Yes.

4209. They are held in trust for the public. Do

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you devote the income to any public purpose if you have a surplus?—At present we are not in that situation.

4210. Did you borrow the money for the construction of those works?—Yes, 3,000*l.*

4211. Are you paying the working expenses and the interest of that borrowed money?—Yes; I think we are about clearing ourselves now, but I am not prepared to answer that question exactly.

4212. Have you any class of nuisances to complain of here, proceeding from any trades or other causes, whatever they may be, locally?—I think that Hertford is peculiarly free from such nuisances now; at the same time we have had considerable complaints with reference to the nuisance arising from the effluvia escaping from the man-holes of the large drains constructed by the New River Company, and that is not cured at present.

4213. Are those drains intercepting drains to take away the sewage?—Yes, those are the large drains that I have spoken to you about, constructed by the New River Company.

4214. You think that the drains are not sufficiently ventilated to carry off the effluvium and prevent the nuisance?—At the present time there is a nuisance which springs from the man-holes or some openings into those sewers.

4215. Have you made any remonstrance to the New River Company?—Yes. The town clerk has been in communication with the New River authorities for some time, and the opinion of counsel has bees taken upon it, which leads us to think that it will be remedied.

4216. Does the river Lee or do any of the tributaries of that river overflow occasionally so as to flood any land?—We have had floods occasionally, but not very lately.

4217. Has there been anything done to decrease the flooding by embankments, or any other improvements in the cuts of the river Lee?—Some few years ago a great improvement was made in the town by the enlargement of the waterway at Cowbridge, and the improvement of the bridge there, I believe, has had a very good effect in preventing the occurrence of floods.

4218. Is the river Lee ever the cause of nuisance in dry weather, or its tributaries?—Not that I am aware of.

4219. Not here?—Certainly not. The water of the river Lee has been analysed after it has passed through the town, and before it passes through the deodorizing works.

4220. Do you know what sources of pollution there are above your town on the Lee and its tributaries?—I cannot speak to that.

4221–2. Do you know that all the sewage of Luton passes in from a population of 20,000?—If it does it is effectually dissipated before it comes to Hertford.

4223. With regard to Luton, you would get anything that comes from there?—If it gets into the river there it does not come here; the river itself is pure now at Hertford; that is proved by the analysis of Professor Taylor.

4224. Is there any sheep-washing in the Lee?—Not within the borough, and I am not aware of any out of the borough.

4225. Evidence has been given that there is sheep-washing in the different tributaries, and that the arsenic used in dressing them is so powerful as to kill the fish to a great extent?—It is quite unknown to us here.

4226. And that a considerable weight of poison passes into the river at Luton which is used in dyeing and bleaching straw plait, and oxalic acid, and different other poisons?—Indeed.

4227. (*Mr. Harrison.*) Who obtained the Act of Parliament under which your town is sewered?—The New River Company.

4228. What was the benefit which the New River Company expected to obtain by carrying out sewerage works for the town?—I think you will get that evidence better from others than myself. I suppose it was with the view of purifying the water that they took from the Lee.

4229. Are they bound by their Act to maintain the sewers that they put down and to ventilate them?—I do not know that there is anything about ventilation specially provided for, but the Act itself is here (*handing in the same*).

4230. The oil mills and the corn mills which you mentioned create no nuisance?—There are two mills, one is above the town, and the other is below the town. I do not myself know exactly what the sewerage of those mills is, but the gentlemen or the owners of those mills will be here.

4231. You are not aware of any nuisance arising from them?—Not to the town. I believe that the sewage from the second mill called, "Baker's Mill," goes into the Lee, but I am not sure of that.

4232. What do you mean by sewage in that case?—What proceeds from the waterclosets, or filth generally.

4233. Not anything properly connected with the mill itself?—I am not able to answer those questions.

4234. Is there any manufacture carried on in the town at all from which pollution arises?—None that I know of. There are only two mills in the town, flour mills, and those two large establishments I have mentioned.

4235. (*Professor Way.*) You say that you cannot answer questions as to those other mills; are they linseed oil mills?—Yes.

4236. You are sufficiently acquainted with them, I suppose, to know that there are only two products from them, namely the oil and the cake?—Yes.

4237. And that there is really no waste?—I am not aware of any waste from those mills that goes into the Lee.

4238. You spoke of Professor Taylor's analyses; those were waters taken at three different places?—I think four different samples were sent to him.

4239. Were any instructions sent with them?—Yes.

4240. Was Professor Taylor's opinion asked on the general question, or as to the analyses of those samples only?—We sent up four samples of water from four different parts of the town, and requested him to analyse those four separate samples of water. He sent down a most careful analysis and a general description of the water. It is more than a mere analysis; it is a report, in fact, on the water supply of Hertford.

4241. I suppose the quantity of water which comes down the Lee to Hertford is very considerable?—Yes.

4242. What distance is Luton from Hertford?—It is about 22 miles.

4243. (*Chairman.*) By the windings of the river it is I suppose considerably more?—Yes.

4244. (*Professor Way.*) It is not very rapid, is it?—I cannot answer that question; in flood times it is.

4245. Still the distance between the two places would afford an opportunity for the stream to deposit anything that was in it?—I am satisfied that anything which enters the river at Luton of a deleterious nature does not come to Hertford.

4246. The distance being considerable the solid matter might be deposited?—Yes.

4247. I suppose that matters in solution are not really precipitated in that way?—I am not scientific enough to be able to answer that question.

4248. You have heard, no doubt, that the poisonous characters of the water are not referable to the large quantity of matter in the water, but to the very small portions of poisonous material which may exist, and which I believe are almost beyond the reach of chemical analysis?—If that is so, I suppose that it cannot be ascertained very easily.

4249. (*Chairman.*) Have you anything further to add?—No.

The witness withdrew.

Mr. Matthew Skinner Longmore (Hertford) examined.

4250. (*Chairman.*) How long have you acted as town clerk to the borough?—I was appointed town clerk last August. I had acted for my father, who was town clerk for 37 years, before. I had been in the habit of acting with him for at least 10 years.

4251. Have you known the town for the whole of that time?—Yes, I was born here.

4252. Are you a solicitor?—Yes.

4253. Have you an intimate knowledge of the Lee as it comes down and goes beyond the borough?—Yes.

4254. Can you describe the condition of the Lee when you first knew it as compared with its condition now; is it different?—I should say not; I mean in its course.

4255. Do you know whether the population has increased in the upper parts of the Lee beyond your borough?—No, I do not.

4256. You do not know that Luton has grown up considerably?—Yes, I know that.

4257. And that other places also have increased in population?—Yes.

4258. Some arrangement was made in 1854, I believe, by which your sewage was diverted from the Lee?—Yes, an Act of Parliament was obtained by the New River Company for that purpose, the Act of 1854.

4259. Was an arrangement made by the corporation with the New River Company to obtain that Act?—No, the corporation watched the bill, and of course took care that their privileges were maintained; and certain clauses were inserted in the bill by the wish of the corporation, but the Act was sought for by the New River Company.

4260. Before the Act was obtained did the entire sewage of Hertford pass direct into the Lee?—I should say a very large part of it did, but not the whole.

4261. This Act was obtained and works were carried out for the purpose of diverting that sewage?—Yes.

4262. Do they carry it down to the disinfecting works and disinfect it?—Quite so. Under this Act, after the New River Company had diverted the sewage, persons had a right to drain into the sewers, surveyors and private individuals; if they do not so they are liable to penalties after the company have diverted their drainage.

4263. There are penalties which prevent them from communicating directly with the Lee, but which compel them to drain into the sewers which are provided?—Yes.

4264. So that the sewage shall be treated before it goes into the Lee?—Yes.

4265. Have you waterworks?—Yes.

4266. Have you any plan of those waterworks?—Yes. I should say that these waterworks are the property of the corporation; they were erected by the corporation, and are worked by steam power.

4267. At what date were they established?—In 1863.

4268. Who was the engineer?—Mr. Gravatt.

4269. Were they constructed under the powers of an Act of Parliament or under your local powers?—The land upon which the engine-house is built and upon which the reservoir is placed was purchased by the corporation with the sanction of the Lords of the Treasury. The money was borrowed with the sanction of the Lords of the Treasury, and is payable off by annual instalments in, I think, 30 years, on mortgage of the borough fund.

4270. Was the money raised under the Municipal Corporations Mortgaging Act?—Yes, under the Municipal Corporations Act.

4271. There is an Act which enables the Lords of the Treasury to sanction the borrowing of money for special purposes which are to be named?—Yes.

4272. Did they send down any surveyor to make an inspection and report before they sanctioned the loan?—No. I think there was a counter-memorial presented from the ratepayers, and the Treasury sent down to the corporation the statements urged by the counter-memorialists with specific questions upon the matter. I think Mr. Ranger was sent down, and he made a report.

4273. Those works are now in successful operation?—Yes.

4274. Have you compulsory powers by which you can compel persons to take your water if you can supply it to them?—No. The arrangement is that the water is let to certain people by the corporation at so much rent per annum; it is regulated mainly by the rents of their houses, but I should say that under the last Sanitary Act that was passed last year there are powers enabling you to compel persons to supply themselves with water for sanitary purposes in case you can show that there is no water upon the property, but of course that would not enable us to compel them to take our particular water; but merely to supply themselves with water for sanitary purposes.

4275. Have you any written analysis of the water?—Yes. I will hand in Dr. Taylor's report (*handing in the same, which will be found printed at the end of the evidence of the witness*).

4276. (*Professor Way.*) Have you a copy of the letter that accompanied the samples sent to Professor Taylor?—I think I can find it. Speaking from recollection, the letter generally asked him to analyse the properties and qualities of the waters, but there was nothing said to Dr. Taylor in reference to any sewage that might empty itself into the water a distance from the town.

4277. (*Chairman.*) The paper which you have handed in contains an elaborate report and analysis of four samples of water from Hertford, and also a report of a chemical and microscopical examination of the vegetable substance contained in the water from the reservoir of the new works?—Yes.

4278. Had that vegetable substance caused any inconvenience in the reservoir to your knowledge?—No.

4279. Why was it submitted for special examination?—I think it was at the time when cholera was prevalent, and it was thought desirable that the water in the reservoir and the river Lee and from the hydrants should be subjected to a chemical analysis.

4280. Is your reservoir an open one?—Yes.

4281. Is it at a sufficient elevation to give you pressure?—Yes, considerable pressure.

4282. What is its size?—I do not know.

4283. Being an open reservoir, I assume that during summer a quantity of vegetation gets into the water, which you thought might be the occasion of mischief, and therefore you had it specially analysed?—Decidedly.

4284. Is this a plan of the waterworks that I have before me?—Yes.

4285. Is the service reservoir at Mole Wood?—No, it is on Port Hill.

4286. What is the well sunk into, is it chalk?—It is gravel.

4287. To what depth is it sunk?—About 15 feet, I am told.

4288. Have you acted at all under the Nuisance Removal Act?—Yes, ever since it was passed.

4289. Have you an inspector of nuisances?—Yes.

4290. Did you hear what the mayor said as to the defective ventilation of the sewers which had been made by the New River Company?—Yes, there is defective ventilation there from the man-holes, they are open. The kind of traps in the street under which the sewers pass are certainly considered offensive in hot weather. I drew the attention of the authorities of the New River Company to the subject, and certainly I consider that under their Act they are liable to keep the sewage free from that nuisance.

4291. Did you on behalf of the corporation ask them to close those openings?—No, I did not ask them to adopt any particular means of abating the nuisance.

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4292. (*Mr. Harrison.*) The New River Company were empowered by the Act to make some main drains through the town ?—Yes.

4293. Leaving it to the corporation, through their surveyor, to make the branch drains ?—No, they made the branch drains where persons had, up to the time of the passing of the Act, drained into the Lee ; they made all the drainage complete, the branch as well as the main drains.

4294. Clause 28 says, "That from and after the "making and the completion of the several new "sewers and drains herein-before described in the "said parishes," &c., "it shall be lawful for all per- "sons resident in the said several parishes and places "to drain their houses and premises, and for all sur- "veyors and others having the superintendence of "the public streets, courts, lanes, and highways "in the said several parishes," &c., "to drain "the same by means of the sewers and drains by "this Act authorized to be made, and from time "to time to make such openings and communications "into the said intended sewers or drains as shall be "necessary for that purpose" ?—Yes, that is for after purposes.

4295. Has the corporation carried out any of those branch drains ?—No, but private individuals have to a considerable extent.

4296. Have none been carried out by the surveyor ? —In some of the parishes the surveyors have done it.

4297. In forming those branch drains has sufficient attention been paid to ventilation?—I think so.

4298. Are there openings from them ?—In some of them, but I am not quite certain about it.

4299. If there are branch drains formed and not ventilated you force all the foul gases to come out of the openings which have been formed by the New River Company in the main drains.—The 29th clause is in these terms : "That from and after the making "and completion of the several new sewers and drains "herein-before described in the several parishes," &c., "it shall be lawful for the company to enter upon "any house, buildings, and premises to collect and "intercept all sewage water from all sewers or "drains leading from houses, streets, or other pre- "mises in the said several parishes or places of "Bengeo," &c., "and which now discharge into the "river Lee or other streams leading into the same, "and to divert the said sewage water into the sewers "and drains by this Act authorized to be made in the "said several parishes and places by means of proper "and sufficient culverts or drains, to be made by "and at the expense of the company from the said "existing sewers of the said houses and streets," &c. That was a clause to intercept all the existing drains and sewers ?—Yes.

4300. And permission was given by the 28th clause for any new sewers to be made and to be connected ? —Yes, we are obliged to give the parties 24 hours notice.

4301. (*Chairman.*) Do you know whether those main sewers have required flushing or cleansing by hand since they were made ?—Yes, certainly.

4302. Is that done by the servants of the company ? —We have done them to a considerable extent.

4303. Your men, I suppose, enter by man-holes, and cleanse those sewers out occasionally ?—I think not ; it has been done by the water of the town.

4304. Have you had any complaint made since the outlet works were established as to any nuisance arising from the water or from the sediment taken out of those tanks ?—I have heard of a complaint, but nothing decided ; I have heard a rumour of it. I will now hand in the plans of the sewerage works which have been made by the New River Company (*handing in the same*).

4305. (*Mr. Harrison.*) Do the New River Company keep the sewers which they have constructed under this Act in repair ?—Yes.

4306. Under which clause are they bound to do so ? —Under clause 4. I consider that as they have constructed the works they are liable to maintain them.

4307. Under one clause there is special provision made in the case of one sewer in the Ware district ; it says it shall be made and at all times be maintained and kept in good repair ?—Yes.

4308. The other clause says, they "may" make and maintain, but there is no clause saying that they "shall," except in that special case ?—No ; but I contend that if they have made the works they must maintain them.

4309. The Lee is navigable to Hertford ?—Yes.

4310. Is it navigable beyond at all ?—I think not.

4311. How long has it been navigable to Hertford ? —I cannot tell you that, but beyond my memory it was navigable, I believe, in 1570.

4312. Do you consider that the navigation is of importance to the borough of Hertford ?—Yes.

4313. Do you find that it is useful and advantageous in competition with the railways ?—I think it is.

4314. Is there much traffic upon it ?—Yes, a considerable traffic.

4315. What has been the effect of the construction of the railways, having two different systems, with respect to the price at which you can obtain coals ?— Coals are considerably cheaper than they were in consequence of the competition, but they are not very cheap now.

4316. Are coals brought by means of the navigation to any extent ?—Yes, I should say they are.

4317. You think that the competition of the three systems, namely, the two railways and the navigation, is a benefit in that way to the town ?—Certainly.

4318. If the navigation were done away with you would suffer from it ?—I think so.

4319. (*Professor Way.*) Have you read this report of Professor Taylor's ?—Yes.

4320. Do you remember generally what the conclusions at which he arrived were ; there were four samples of water sent to him, and he finishes with a conclusion. Do you remember generally what it was ? —Yes.

4321. Two of the samples were taken from the new works, one from the old waterworks, and one from the river Lee ?—Yes.

4322. I was under the impression that these waters were taken from different parts of the Lee passing through the town ?

(*The Mayor.*) No, only one was taken from the Lee below the town.

4323. At the old waterworks ?

(*The Mayor.*) Yes ; although it is nearly the centre of the town it is below where the drainage of the town would be.

4324. You will observe that he speaks of the samples as generally good and wholesome water, fit and proper for the supply of the town for drinking and ordinary domestic purposes. He then describes three of the samples, and finishes with a sample which he calls letter "A," and which sample is taken from the Lee ?—Yes.

4325. Does that convey to you the impression that that water of the Lee contains something different from the water pumped from the other sources ?—Yes, it does certainly.

4326. Leaving out the question as to how far that impurity goes, which he says is small, does that impress you with the notion that some kind of impurity of an organic character is contained in that water ? —It might be so.

4327. Is not that what Professor Taylor says ?— Yes.

4328. So far we may say that the water of the Lee is not absolutely a pure water ?—I admit that there is some difference, certainly.

The witness withdrew.

REPORT (referred to supra, Question 4275) OF ANALYSES OF FOUR SAMPLES OF WATER FROM HERTFORD.

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The waters were delivered to me on Thursday, August 16th, 1866, by superintendent Jarrett. I was informed that they had been taken from their respective sources on the previous day. They were contained in stone-ware gallon bottles well secured, properly sealed, and labelled. The examination of these samples was commenced on Friday August 17th. The four samples were numbered by me for the convenience of reference; they were as follows:—

No. 1. From the well at new waterworks.

No. 2. From the reservoir of the new waterworks.

No. 3. From hydrant in the street.

Letter A. From the river Lee at the old waterworks, Hertford.

Physical Properties.

The four samples were clear and bright, they contained no mechanical impurity, and deposited no appreciable amount of sediment on standing 48 hours. They had no smell upon opening the bottles, and no effluvia or gas escaped. When the waters were examined in tall jars Nos. 1 and 3 were colourless, but No. 2 and A presented a slightly yellowish colour, such as is sometimes produced by the presence of a small quantity of iron. They were all tasteless excepting A in which a slight taste was perceptible, such as might be produced by the accident of decayed leaves or grass getting into the water. The samples were aerated in about the same degree as good spring or river water; they contained free carbonic acid, and the ordinary elements of the atmosphere, namely, oxygen and nitrogen.

Chemical Constitution.

The usual chemical tests and processes applied to the four waters, showed that they contained only the saline compounds commonly found in good river and spring water, and in about the ordinary proportions. The principal ingredient was the carbonate of lime (chalk) with small quantities of sulphate of lime and chloride of sodium, and with still smaller quantities of magnesia, potash, oxide of iron, and silica. The sulphate of lime was in larger proportion in Nos. 1 and 3 than in No. 2 and A, and the quantity of lime deposited from Nos. 1, 2, and 3 was somewhat larger than that deposited from A. No. 2 and A produced with pure alumina a slightly coloured deposit, (oxide of iron), while in Nos. 1 and 3 the deposit was of a pure white. The four samples were especially tested for oxidizable or decaying organic matter, and for those gases which are imparted by leakage of coal, gas, sewage, or other offensive matters of a like nature. The result was that none of them contained any matters noxious to health. It should be observed, however, that in No. 2 and A the presence of some oxidizable substance was indicated by the test, (permanganate of potash) after the lapse of a few hours, and at the same time there was no such indication in the waters Nos. 1 and 3.

On boiling the four waters the carbonic acid which they contained was expelled, and after a time they become slightly, but in an equal degree, milky-looking from the separation of carbonate of lime. This is the special character of all spring waters which contain the carbonate of lime dissolved. No offensive effluvia were given off during the process of boiling, and the waters when filtered from the calcareous deposit were quite clear and considerably reduced in their degree of hardness.

Portion of Nos. 3 and A were distilled, and the distilled liquids obtained from them were further examined for any volatile matters which might have escaped detection in the entire water. In the distilled liquids of these two samples there was a trace of ammonia, but no volatile matter of an oxidizable nature or in a state of decay.

By evaporation of the waters, a solid chalky-looking and dry substance was obtained from each sample calculated for the imperial gallon of 70,000 grains; the weight of the dry residue in grains obtained from each sample was respectively in No. 1, 14·4 grains; No. 2, 20 grains; No. 3, 19·2 grains; Letter A, 14 grains.

These results show that the samples contain only the average weight of solid matter which is usually found in good river and spring water. No. 1 and A are almost identical, and the same may be said of Nos. 2 and 3. The differences between these last-mentioned samples (2 and 3) and No. 1 probably depend on local circumstances connected with storage and distribution.

The dry residue of each water was nearly white or of a greyish white colour. They were all darkened when heated to low redness, a fact showing the presence of some organic matter, and there was evolved from each a smell resembling that of burnt vegetable matter. The blackening of the dry residue by heat was most marked in A. None of the residues underwent fusion or gave off acid vapours. All evolved traces of the alkaline vapour, ammonia, showing the presence of nitrogen in the organic matter; there were also traces of sulphur, but the presence of this element was most marked in 2 and A. The residues contained in a concentrated form the salts found in the entire waters, but in addition alkaline nitrates were found in the residues of Nos. 2 and 3 and of A; in Nos. 2 and 3 these were less than in the water A. In operating upon a similar quantity of No. 1 no nitrates could be detected.

The proportions by weight of the mineral or fixed matter and of the organic and volatile matter contained in an imperial gallon, or 70,000 grains of each water may be thus stated for each sample:—

No. 1. Water from the Well New Works.

	Grains.
Mineral or fixed matter, chiefly carbonate of lime, with small quantities of sulphate of lime and chloride of sodium - - - - -	12·0
Organic matter and matter volatile at a red heat	2·4
Total weight in grains in imperial gallon -	14·4

No. 2. Water from the Reservoir New Works.

	Grains.
Mineral matter, as in No. 1, with traces of alkaline nitrates - - - - -	16·8
Organic matter containing nitrogen and sulphur, and matter volatile at a red heat - -	3·2
Total weight in grains in imperial gallon -	20·0

No. 3. Water from Street Hydrant.

	Grains.
Mineral matter, as in Nos. 1 and 2, but with more alkaline nitrates than in No. 2 - -	16·0
Organic matter with nitrogen and sulphur and matter volatile at a red heat - - -	3·2
Total weight in grains in imperial gallon -	19·2

Letter A. Water of River Lee Old Works.

	Grains.
Mineral matter, as in Nos. 1 and 2, with alkaline nitrates as in No. 3 - - - -	12
Organic matter with nitrogen and sulphur, and matter volatile at a red heat - - -	2
Total weight in grains in imperial gallon -	14

The hardness of these waters was determined by a solution of soap in alcohol, compared with an equal volume of distilled or pure water as unity; the relative hardness in degrees may be thus represented both before and after boiling:—

	No. 1.	No. 2.	No. 3.	Letter A.
Before boiling	10°	10°	11°	11°
After boiling			6·3	6°

Thus it would require eleven times as much soap to give a lather or detergency to water in a gallon of No. 3 or A before boiling as would be required to produce a similar lather or detergency in a gallon of pure or distilled water. A gallon of the boiled water of No. 3 or A would require six times as much soap as a gallon of absolutely pure water. This shows that the waters lose one-half of their hardness as a result of boiling. On Dr. Clark's scale of degrees the figures would be higher, but the proportions would remain the same.

Conclusion.

The result of this analysis shows that the four samples of water are good, wholesome, and fit and proper for the supply of the town for drinking and ordinary domestic purposes. Compared with the lake waters of Scotland, Cumberland, or Wales, they would be regarded as hard, but the hardness is not greater than that of river waters supplied to the metropolis and to the southern districts of England. The hardness is of a temporary kind, and is reduced to nearly one-half as the result of boiling. The hardness as it exists in these waters affects the question of economy in the use of soap for washing, it is not of that degree to render them unwholesome or unfit for drinking. Besides it must be remembered that the disadvantage of hardness is in a great measure compensated in a sanitary point of view, by the fact that as a rule waters of this composition do not exert any chemical action on metallic lead either in pipes or cisterns, and thus they are not liable to occasion lead-poisoning like waters which contain less saline matter and are therefore much softer.

The differences among these four samples are in a practical point of view so slight as not in any way to affect their qualities for domestic use or their wholesomeness for drinking.

Among the four samples, No. 1, by reason of the small proportion of saline matter in the gallon, and from its

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entire freedom from the oxidized products of organic matter (alkaline nitrates) takes the first place. It has evidently not been exposed to any source of contamination. Of Nos. 2 and 3; it may be observed that although they have a constitution similar to No. 1, they acquire from some source small quantities of mineral and organic substances which add to the proportion of solid contents after the water has issued from the well.

Of the letter A or Lee River water it may be said that its composition is very similar to that of No. 1, but it is inferior to it in these respects, the organic matter contains sulphur and nitrogen, and the mineral matter alkaline nitrates, showing that, as a result of exposure, this water has acquired nitrogenous organic matter, which by conversion into ammonia and subsequent oxidation has produced nitric acid. The nitrates are, however, so small in quantity as not seriously to affect the water for drinking purposes; the nitrates are generally found in river water in inhabited districts but commonly only in traces.

(Signed) Alfred Swaine Taylor, M.D., F.R.S.,
Professor of Chemistry and Medical Jurisprudence in Guy's Hospital, and Fellow of the Royal College of Physicians, &c.

15, St. James' Terrace, Regent's Park,
August 24, 1866.

Report (referred to supra, Question 4275) of a Chemical and Microscopical Examination of a Vegetable Substance from the Reservoir of the New Works.

This substance was handed to me for examination by superintendent Jarrett at the same time with four samples of water, on which I have already reported. I was informed by him that it was taken from the banks or side of the reservoir.

It consisted chiefly of filaments of confervæ and other minute fresh water plants forming a kind of net work or sponge, partly bleached by exposure to light, and partly retaining its green colour. It was mixed with a quantity of mineral matter. This consisted in part of sand and earthy substances, and in part of the skeletons or mineral cases of numerous varieties of infusorial animals. The substance also contained a certain amount of moisture which it retained owing to its spongy texture.

It was submitted to a chemical analysis, and it was found to be thus constituted:—

Organic matter, filaments of fresh water algæ - -	31·4
Mineral matter consisting of silica, carbonate of lime, and alumina - - - - - -	40·0
Water or moisture driven off at a heat of 212° -	28·6
	100

A microscopical examination showed that the filaments were chiefly those of the *confervæ glomerata*, having a diameter of about the 1,500th of an inch. When the dry substance was heated a large quantity of ammonia and sulphur were evolved, and very offensive effluvia escaped. A grey ash remained after perfect combustion, which consisted of the mineral substances above mentioned, mixed with some oxide of iron. The dust shaken from the vegetable substance, when examined microscopically, consisted of dead navicula and other infusorial animalcula.

These confervoid substances are produced in all water at the expense of the elements of the air and water, whenever the water is *exposed to light*, and is at the same time stagnant. They can only grow in water if exposed to air; on the bank they wither and decay, they are also liable to decay in water, and thus affect it in variable degrees.

The chemical differences between No. 1, the well water, and No. 2, the reservoir water, appear to depend on the well water acquiring an impregnation or an addition of mineral and organic matter in the reservoir in which it is stored. This addition of foreign matter is not such in quantity or quality as at present to affect the properties of the water; but it would be desirable to preserve the water before distribution as far as possible in the state in which it is procured from the well. The free production of confervæ diatoniaceæ and other fresh water plants, leads in all cases to the formation of a thick, green scum which is liable to decay in hot weather, and as the plants contain a large amount of sulphur and nitrogen, these elements or their products are liable to be transferred to the water, and thus render it less pure. This growth of conferveæ was one of the main causes of contamination of the water supplied to London before the Act of 1851. The reservoirs were open, exposed to light and to the reception of all atmospheric impurities. The Act required all reservoirs for the storage of water within seven miles of St. Paul's should be *covered over*. This has been attended with a material improvement in the water. The confervoid plants do not grow, or only to a slight extent, and the water is kept freely aerated by doors at the side of the covering roof.

There is another fact which requires to be pointed out. Whenever these fresh water plants grow in the water of reservoirs, infusorial animals appear in myriads. These are also subject to death and decomposition, and they thus become an element in adding to the impurities of the water. The confervæ are the food of these animals, and the prevention of their vegetable growths operates to prevent the production of these low forms of animal life.

I would therefore beg leave to suggest that the reservoir from which No. 2 has been taken should be *covered* or *domed over* like the reservoirs of London, taking care at the same time that there is free ventilation. This plan would, I believe, have the good effect of preserving the water No. 2, and keeping it in the state in which it is received (as No. 1) *i. e.* free from any additional source of animal or vegetable impurity. With regard to mineral matter, this is sometimes acquired by water from the cement or materials of which a reservoir is constructed. After a time, however, this source of impurity ceases.

When we speak of impurities in water, we must remember that no water which has once touched the earth can ever be found *pure* or entirely free from the salts of lime, or soda, or from organic matter. The purest lake water in the world, that of Loch Katrine, contains organic matter. I have had opportunities of examining water from the Geyser springs of Iceland in the north to the Yara Yara river in South Australia, and from Vancouvers Island on the western coast of North America to the river Jordan in Syria, and I never found any sample without mineral and organic matter. It is desirable, however, when water is selected for drinking purposes, that we should, as far as possible, avoid adding to the quantity of foreign matter already existing in it. River water is necessarily exposed to light and air, and is liable to suffer damage from drainage as well as from the growth and decay of vegetables upon the banks. Good spring or well water when once obtained is not liable to these accidental causes of contamination, and, when once received in a reservoir, it may by attention to certain points be distributed in as pure a state as it is at the source.

(Signed) Alfred Swaine Taylor, M.D., F.R.S.,
Professor of Chemistry and Medical Jurisprudence in Guy's Hospital, Fellow of the Royal College of Physicians, &c.

15, St. James' Terrace, Regent's Park,
August 24, 1866.

Mr. J. Marchant, jun.

Mr. John Marchant, jun. (Hertford), examined.

4329. (*Chairman.*) Are you clerk to the River Lee Trust?—I am.

4330. Will you kindly explain to the Commission what the statutory powers of the Trust are?—Yes. I have drawn out a short statement, a sort of historical statement of the constitution and powers of the Trust, which I will refer to, and then hand in. (*The witness subsequently handed in a Paper, which will be found printed at the end of his evidence.*) The navigation of the river Lee is managed and governed by a public Trust, incorporated by the name of "The Trustees of the River Lee." They derive their powers from various Acts of Parliament, the earliest of which were passed in the reign of Henry 6th. The first Act, cap. 5, was passed in the third year of his reign, 1424, and the second, cap. 9, in the ninth year of the same reign 1430. Those two statutes empowered the Chancellor for the time being to issue Commissions for the purpose of clearing, scouring, and amending the river "Ley," which in both of them is stated to be "une des grandes rivers" of England. Then I would pass on to the year when the river was rendered navigable.

4331. (*Mr. Harrison.*) Between what points?—In those Acts no points are defined, but in subsequent Acts the navigation is defined from point to point. In the 13th year of the reign of Queen Elizabeth the river appears to have been rendered navigable, and the constitution of the River Lee Trust may be said to have been first established in that reign. In the

13th year of Elizabeth, 1570, an Act was passed, cap. 18, "for the bringing of the river of Lee to the "north side of the city of London." By this Act the Lord Mayor, commonalty, and citizens of London and their successors were authorized to bring the said river of Lee from the town of Ware to the north side of the city of London; and by section 4 it was enacted, "That the said Lord Mayor, commonalty, and citizens "shall have the whole jurisdiction, conservice, rule, "and government, as well as the said new cut river "and ground of each side, as also the royalty of the "fish and fishing of the same, and the profits of the "said ground, soil, and water to them and their "successors for ever." Power was also given by this Act for the punishment of offenders and persons breaking the rules and orders provided for the preservation and maintenance of the said river.

4332. (*Chairman.*) Was the section you have just read enacted for the purposes of the navigation, or for water supply, or both?—For the navigation only.

4333. The navigation and the fishing?—Yes.

4334. (*Mr. Harrison.*) Was power given to them to dredge the river and sell the ballast?—Yes. Then certain trustees were mentioned in that Act and appointed. I then come to an Act passed in the 12th year of the reign of George II., cap. 32, 1739, and certain trustees were added to the corporation.

4335. Had they a joint interest with the corporation?—Yes, they were local individuals. I may mention that there were to be "16 commissioners," who were to act with the corporation, "viz., four "of the city of London, and four of each of the "shires of Essex, Middlesex, and Hertford, having "lands, tenements, or hereditaments of the clear "yearly value of 40 marks, and not being London "traders." The power given to them was, "to "treat, agree, and compound for the scouring, "cleansing, repairing, and keeping of the said river "Lee." In 1739 an Act was passed, the 12th George 2nd, cap. 32, "For ascertaining, preserving, and im- "proving the navigation of the river Lee from the "town of Hertford to the town of Ware, in the "county of Hertford; and for preserving and im- "proving the said river from the said town of Ware "to the new cut or river made by the mayor, com- "monalty, and citizens of London; and for enabling "the governor and company of the New River the "better to supply the cities of London and West- "minster, and the liberties and suburbs thereof, with "good and wholesome water." That is the first mention of a supply of water from the Lee. By this Act the course of the river was defined, and certain persons therein named were appointed for the putting in execution the powers and trusts by them reposed, by virtue of and in pursuance of that Act, for the purposes therein expressed. I may here mention that the body of Trustees consists of the following *ex-officio* members; the Lord Mayor, aldermen, and recorder of the city of London for the time being; the knights of the shire for the county of Middlesex, the members of parliament for the city of Westminster, the knights of the shire for the counties of Essex and Hertford, the members of parliament for the boroughs of Colchester and Hertford; the mayor of Hertford for the time being, and noblemen and gentlemen from time to time elected from the counties of Hertford, Essex, and Middlesex. The governor, deputy-governor, and treasurer of the New River Company for the time being are also *ex-officio* members of the trust.

4336. Does that constitution of the body of Trustees continue to this day?—It does. I then come to another Act which was passed in 1766, in the seventh year of the reign of George the 3rd, cap. 51, for improving the navigation of the river Lee from the town of Hertford to the river Thames; and for extending the said navigation to the floodgates belonging to the Town Mill in the said town of Hertford: that is the extreme limit of the navigation as at present constructed. By this Act the trustees appointed by the 12th George 2nd, cap. 32, together with several other noblemen and gentlemen therein named, were appointed "trustees "for the making, extending, improving, and main- "taining the navigation of the said river Lee from "the floodgates belonging to the Town Mill, in "the town of Hertford, to the river Thames, and "for putting this Act in execution:" and they were empowered to cleanse, scour, deepen, enlarge, or straighten the channel of the river Lee, and to make and maintain the new cuts therein described, and to build the bridges and works therein mentioned. That was the first period of canalizing the river Lee. By this Act the navigation was declared to be a free navigation for all the King's liege people, subject to the payment of such rates and duties which were thereby authorized to be levied. Then I come to another Act passed in 1779, the 19th George 3rd, cap. 58, which was an Act to authorize the raising of certain additional tolls which are mentioned there. Then in the year 1805 an Act was passed, 45th George 3rd, cap. 69, for the better preservation and further improvement of the navigation, defining certain heights of water and giving power to the Trustees to make bye-laws for regulating the lading of barges. It was also provided that no craft should carry more than 40 tons of freight. That provision has since been repealed, and now there is no limit to the tonnage that may be carried; it sometimes exceeds 80 and 90 tons. The next Act was passed in the 13th and 14th years of the reign of Queen Victoria, cap. 109, called "The "Lee Navigation Improvement Act, 1850." The principal objects of this Act were to enable the Trustees further to improve the navigation and dispose of the surplus water. The Trustees were incorporated by the name of "The Trustees of the River Lee," and were empowered to purchase and hold, and sell, demise, and dispose of lands for the purposes of that and the therein recited Acts.

4337. What was the meaning of disposing of the surplus water?—That we may dispose of the water to companies and to individuals for a water supply. I may state here that there is a subsequent Act which vests the surplus water in two companies, namely, the New River Company and the East London Water Company.

4338. Is there any provision under that head of "disposing of the surplus water" for passing the water freely off the land?—No, that Act enables the Trustees to raise funds.

4339. In the Acts which you have mentioned up to the present moment there is no power given to raise money?—Yes; I think there is. Money has been borrowed; there was power to buy land in the Act of the seventh of George III., cap. 51, section 5. The Trustees were empowered to treat and agree with the owners and proprietors of land and property, and they were enabled to pay for that land and property either by way of purchase in a gross sum or by annual payments, and certain annual payments are still made by the trust.

4340. How was the money to be obtained?—The money to be raised was by annuities. The Trustees were enabled to create annuities for the purpose of raising money. Annuities were raised and have since been paid off. In 1850 the Trustees were empowered to raise on mortgage upon the security of the tolls and property of the trust 230,000*l.* Those borrowing powers have been exercised to a certain extent, and the money has been laid out in the improvement of the navigation and renewal of the works.

4341. (*Chairman.*) Is that the most recent Act under the powers of which you are now working?—Yes. There is an Act which has been passed since, the Act of 1855, which transferred the surplus water of the Lee to the two companies, but our own maintenance and working are under the Act of 1850.

4342. (*Chairman.*) The money which has been raised and expended has been raised and expended under the powers of the first of those Acts which you have named?—Yes.

4343. The debt, whatever it may be, is secured by arrangement under that special Act?—Yes. Then I

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come to the Act of 1855, the 18th and 19th of Victoria, cap. 196.

4344. Is that the most recent Act?—Yes. This is called "The River Lee Water Act, 1855." By this Act the surplus water of the Lee over and above the quantity required for the purposes of navigation was vested in those two water companies respectively, subject nevertheless to such rights as might not then belong to the Trustees. The daily quantities of water reserved to the Trustees for navigation purposes and not subject to any control by the water companies are as follows: first, they may pass through their locks from the highest point at which the water companies or either of them take their supply down to and including the first lock above Fielde's Weir (called "The Upper Reach") not exceeding in any 24 hours 576,000 cubic feet per diem.

4345. The companies referred to there being, I assume, the two water companies you have mentioned?—Yes, the New River Company and the East London Water Company. Secondly, they may pass from the first lock above Fielde's Weir exclusive down to and including Waltham Town Lock (called the Middle Reach), not exceeding in any 24 hours 720,000 cubic feet. Thirdly, they may pass from Waltham Town Lock exclusive down to and including Old Ford Lock (called the Lower Reach), not exceeding in any 24 hours 864,000 cubic feet. All water below Tottenham Mill not required by the two water companies at their drawing stations is reserved to the Trustees for navigation purposes. By that same Act the two water companies are strictly forbidden without the consent of the Trustees, at any time to draw from the river so as to reduce the water in any pond of the navigation below the customary head level of that pond.

4346. (*Mr. Harrison.*) That limits your navigation?—Yes, it does, but I believe that limit has never been attained. Below Tottenham Mill the whole of the water belongs to the River Lee Trust. The priorities of rights to take the water of the river Lee are very clearly defined by this Act and are as follows: first, the right of the Trustees to the upper, middle and lower daily quantities, and such further quantity as shall be necessary to maintain the water of the navigation on a level with the head levels aforesaid; secondly, the right of the New River Company to take 2,500 cubic feet a minute; thirdly, the right of the East London Waterworks Company to take 2,500 cubic feet a minute; fourthly, the right of each company to take, *pari passu*, 500 cubic feet a minute; fifthly, the right of each company, after notice, to take, *pari passu*, any additional quantity; sixthly, the right of the Trustees to surplus water below Tottenham Mill.

4347. You have the first claim upon the water up to the limits you have mentioned?—Quite so.

4348. The companies have power to take 2,500 cubic feet per minute at the same time?—Yes.

4349. If there is a surplus beyond what you require and they require, they can each divide it in equal proportions?—Yes.

4350. To any extent that that surplus may be?—Yes.

4351. Below Tottenham you have the entire control of the remaining water, whatever it may be?—Yes, that is so. These Acts which I have cited give the whole jurisdiction, conservancy, and government of the river to the Trustees of the river Lee, and they give them a priority of right to the quantity of water necessary for navigation purposes. That exhausts the constitution and statutory powers of the trust.

4352. (*Chairman.*) What are your executive powers as a trust?—We meet monthly and dispose of all the business which comes before the Trustees; the meetings are, in fact, general meetings; that is to say, all the Trustees receive notice; they are not committee meetings, but we deal with all questions affecting the navigation other than those of nuisance; that is to say, we have not power to deal with nuisances under the Acts.

4353. Where do the meetings take place?—At Hertford during part of the year, and in London during the session of Parliament.

4354. Are the Trustees a paid body?—No, unpaid.

4355. Is there any allowance made for travelling expenses?—None whatever.

4356. Each member of the trust travels to and from each place at his own proper charges?—Quite so.

4357. Do those meetings take place essentially for the purpose of regulating the navigation traffic and business of the river?—Yes, and to receive communications from traders and parties using the navigation.

4358. What is the present debt of the Trustees?—174,287*l.*

4359. You have power to borrow to what amount?—230,000*l.*

4360. You have not borrowed to the maximum that you are authorized by the recent Act to borrow?—Not by a sum of 55,713*l.*

4361. Then the money is borrowed, I suppose, from any individuals who choose to lend it?—Yes.

4362. Have the Trustees borrowed any of it from the Exchequer Loan Commissioners?—No.

4363. Is there any authority in the Act to enable the Exchequer Loan Commissioners to lend money to the Trustees?—I think not.

4364. Upon what terms have you been enabled to borrow that money as to interest, and what is the period allowed for repayment?—At $4\frac{1}{2}$ and 5 per cent., upon terms varying from three to seven years.

4365. You have borrowing powers, and I assume reborrowing powers?—Quite so.

4366. You can pay off and reborrow to replace the the money?—Yes.

4367. Are you bound by the terms of the Act to repay that money, or may it remain a permanent debt?—We are not bound to repay it.

4368. You are not bound, when money is borrowed by the trust for water supply and other purposes, by Act of Parliament to repay it either in 30 or 50 years?—There is no limit in this case.

4369. It is borrowed upon the security of the tolls?—Yes, and other property of the trust.

4370. In the event of railway competition, or any other form of competition, or any alteration in trade, diverting traffic from the river, and reducing the income of the trust, is there any outside security to the lenders of the money?—We possess land and mills, and annuities, secured by Act of Parliament from the water companies.

4371. You have an income from the water companies?—Yes.

4372. I believe the amount was mentioned by your engineer?—Yes, 3,500*l.* I might mention just to qualify your observation, that in 15 years, from tolls alone, we have doubled our income during the period of railway competition, we have annuities secured by the Act, and we have mill property and land; a valuation of that has been made within a recent period, and it is a very large sum indeed; that is over and above the tolls.

4373. You have a profitable trade now, and one that has for many years back been growing?—Yes; this year we shall realize 1,000*l.* upon the river more than at any other period.

4374. I may ask you, perhaps, whether your traffic manager will attend to give evidence?—He will.

4375. He will, perhaps, put in the tonnage carried upon the Lee, showing the rate of increase, and also the income derived from that tonnage?—Yes, he will.

4376. Have the Trustees power to increase the rate of charge over and above what is at present paid, supposing that they resolved to do so, to meet their engagements?—Yes, they can considerably increase it.

4377. At the present time you do not charge the maximum rate that you are empowered to charge?—No; take, for example, these four items, coals, malt, flour, and sundries. Coals may be charged 2*s.* $2\frac{1}{4}$*d.* per ton, whereas we charge 6*d.*; malt may be charged 2*s.* $1\frac{1}{4}$*d.*, whereas we charge 1*s.*; flour may be charged 1*s.* $8\frac{1}{4}$*d.*, whereas we charge 1*s.*; sundries may be charged 1*s.* $9\frac{1}{4}$*d.*, whereas we charge from 1*s.* 3*d.* to

1*s.* 2*d.* We lower our tolls from time to time as the exigencies of trade or our finances admit.

4378. (*Professor Way.*) As a matter of policy?—Yes.

4379. (*Chairman.*) You are able now to offer good security for any money you may wish to borrow to improve your works?—We think so, and with a very considerable margin.

4380. In the event of your continuing to earn a surplus would the Trustees be authorized to pay off any of the mortgage bonds, or would they, instead of that, reduce the rate of tolls?—They have power to do either; they have power legally to pay off the bonds, because some of the debentures are overpaid; some parties prefer the security, and they allow them to remain. The Trustees would probably consider whether it was desirable to pay off some of their debt, or to lower the tolls for the public. As long as the trade remained in an increasing condition I presume they would pay off the mortgages in preference to lowering the tolls.

4381. In the event of the day coming when the trade of the district was found to be so profitable that they could wipe off their mortgage debt altogether, and have the whole income available, except for the payment of the salaries of their officers, does the Act point out any arrangement that might be made?—The navigation would become a free one absolutely.

4382. The tolls would then be reduced to a minimum to provide for the payment of the salaries and so forth?—Yes, there must be some revenue for that purpose, for maintenance and for repairs, but that might be met probably by the payments made by the water companies or by rentals.

4383. Can you explain to the Commission the special circumstances under which this town has been sewered and drained; has it been done by the river Lee Trustees or entirely by the New River Company?—Entirely by the New River Company, and for their own purposes; it was done under a special Act of Parliament obtained by them.

4384. Have the Trustees of the Lee been at all troubled by pollutions caused in the course of the navigation?—Yes.

4385. Have they ample legal powers to deal with parties who cause nuisances?—They have no legal powers other than the common law rights which individuals possess in such cases; they have no statutory powers to deal with nuisances. There is one section in our Act which enables them to inflict penalties upon parties who maliciously cast refuse into the river, building refuse and so on. The words are, "if any person "shall wilfully throw any gravel, ballast, stones, rub-"bish, or dirt" (*reading from the Act to the words*) "not exceeding three months."

4386. What clause do you refer to?—The 109th clause of the 7th George 3rd, chapter 51.

4387. Would the word "intent" in that clause so qualify the intent and meaning of that clause as to render it inoperative?—Perfectly so; I consider that that word "intent" entirely prevents the clause being operative.

4388. If you were to summon a man, would you not have great difficulty in proving what he "intended" to do?—It would be utterly impossible to prove it.

4389. That clause requires amendment, does it not?—Yes; I have never heard of an attempt yet being made to put it in force.

4390. (*Mr. Harrison.*) So far as the clause goes, would not the word "dirt" include sewage?—Yes, I think it might; but then it must be proved that there was a wilful intention on the part of the offender to obstruct and injure the navigation.

4391. (*Chairman.*) If the framers of the clause had been satisfied with saying that proof of having thrown solid refuse into the river should be sufficient, do you think you could have put the Act in force?—Yes.

4392. But when it puts upon you the onus of proving a man's intention it takes away the whole sting of the clause?—It does; the Trustees have very much regretted that they had not the power which the Thames Conservancy are able to exercise. I understand that they have carried those powers into operation—the powers given to them by the last Act of 1854; indeed I know they have, because I have supplied them with evidence, which has enabled them to obtain a conviction.

4393. Might I ask you whether the Trustees have discussed recently the advisability of obtaining additional legal powers similar to those which are embodied in the Conservancy Act of last session for the river Thames?—They have in reference to that and many other objects, and it is thought desirable to obtain powers for the same purpose. The Thames Conservancy, since the passing of their Act of 1864, have taken proceedings in six cases, in which they have obtained convictions under the three-mile clause.

4394. What cases were those?—One was the case of H. Tallerman, who was fined 5*l.*; a man of the name of Stevens was fined 5*l.*; another of the name of Crossley was fined 5*l.*; in the case of Denton and Jutson the case was dismissed on their agreeing to alter their pipes; in the case of Batley and Butler the case was dismissed on their agreeing to alter their pipes; the case of Messrs. Abbott was adjourned till the following Friday to ascertain the result of a wall that was in course of erection. These were cases of nuisances on the Limehouse cut, the refuse being discharged into the river Lee.

4395. Was it solid refuse that was thrown in?—It was refuse from their manufactories, liquids and solids together.

4396. The proceedings in those cases were taken under the Act that was obtained in 1864?—Yes.

4397. Are you acquainted with the clauses generally in the Act passed in the last session for the future government of the Thames?—I have read it.

4398. It gives to the conservators, after notice, power to remove weirs, to take possession of locks, to remove or lower mill dams, and absolutely to prevent the sewage of any town or place from being thrown into the river?—It does.

4399. (*Mr. Harrison.*) Did the cases to which you have referred come under your notice as having a joint interest in Bow Creek with the Thames Conservancy?—Yes, they were our complaints in point of fact. We brought the matters before the conservancy, our officers were directed to give evidence, and convictions were in that way obtained, I think, in all the six cases; they all occurred in our district.

4400. Have they taken any action out of your district that you know of, or do they do so only when a matter is seriously forced upon their attention?—I am not aware.

(*Mr. Beardmore.*) I may be allowed perhaps to say that the Thames Conservators are constantly prosecuting offending parties; not a week passes without that being done.

(*The witness.*) I might mention other cases of nuisance. One or two of these cases we took before the police magistrates ourselves, and in the case of Tallerman we failed because we had not the power which the Thames Conservancy enjoy.

4401. (*Chairman.*) Is that the general character of the nuisances you have to complain of, polluting the waters of the navigation?—Yes; beginning with Ware, and down to the effluence of the Manifold ditch which conducts the water from the sewage works at Hertford, I think I may say that the water is extremely pure, that is to say, I am not speaking chemically, but to all appearance and taste. When we get below Ware lock the first real nuisance commences at the point where the outfall of the sewage water from Hertford takes place, that is the water which is brought there and which has passed through the deodorizing works at Hertford which were constructed by the New River Company.

4402. Do you know sufficient of the character of that effluent water to be able to say whether it has ceased to be the cause of nuisance, and therefore unobjectionable?—I think it is neither one nor the

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other, but I will say this, that it is most undoubtedly to the interest of the navigation that the water should be kept pure; that is necessary for the navigation. There must be a certain amount of solid deposit if you get filthy water, and therefore it will affect our navigation. In course of time it will silt up the bed of the river, and it does do so. We have, in consequence, to spend large sums of money in dredging out the sewage mud which accumulates in the river.

4403. Are you chemist enough to know that no disinfecting process or any treatment of that kind does anything but remove the solids; it does not touch the salts of sewage which are incorporated chemically with the water?—I do not know that of my own knowledge, but that is what I hear.

4404. (*Mr Harrison.*) After undergoing the process of clarification adopted by the New River Company is there any deposit in your navigation from the effluent water from the deodorizing works?—There is certainly an accumulation, whether it is a deposit of solid sewage which has floated down, or sewage in solution, I do not know, but I have observed that there is an accumulation of a black substance occasionally. In passing there you may see floating on the surface what appears to be at first sight floating sewage; it appears like nightsoil, but if you examine it you will find what it is; it is simply a confervoid growth which has risen from the bottom, and which has grown up from the presence of the sewage water. The sewage water seems to have fertilized the bed of the river. I have examined some of these collections and found that they were vegetable, not sewage. I suppose it is nature's method of clarifying the water.

4405. Is the water that is discharged from the works in appearance clear as it passes along and before it reaches the navigation?—I have seen it perfectly clear, and I have seen it also looking somewhat peaty, as though it had passed over peat of a brown colour; I cannot say that at all times, for instance, in hot weather, it is perfectly clear.

4406. Notwithstanding it appears to be quite clear as it passes from the works, when it reaches the navigation there is a deposit of some kind which gives rise to the results you have mentioned?—Yes, there is certainly a discolouration.

4407. After it mixes with the water of the navigation?—Undoubtedly; and I have been told by parties who have complained, that there is absolutely a smell and a great nuisance. We have received complaints from the Ware local board of health upon the subject.

4408. (*Chairman.*) The smell would probably come from two causes; first, the heat of the weather, and, secondly, the length of time during which the sewage has stagnated in the sewers before it got into the open air?—No doubt; we then come within 300 or 500 yards of the main sewer of the town of Ware, which is as abominable as it can possibly be; no attempt is made at deodorization, or any process which shall render it innocuous.

4409. It comes down as it is delivered from the town, does it?—Yes.

4410. Have you given them any notice upon the subject?—We have complained, but I may say that there is a little counter irritation in this case. They send us a complaint as to the Hertford sewage, and then we refer them to the nuisance they create.

4411. (*Professor Way.*) I suppose you have no doubt that the measures taken at Hertford to precipitate the sewage place the river in a better position than it is at Ware?—Yes, certainly.

4412. At Hertford the evil is greatly mitigated?—Yes, the work is done there as well as one could think it possible to do it by the process which they adopt.

4413. (*Mr. Harrison.*) Is any bank formed in the navigation below the point where the Ware sewage is discharged?—Yes, I believe there is one accumulated, and we shall have to incur expense in clearing it away.

4414. Is that an obstruction to the navigation?—It will become such.

4415. Cannot you under your Act proceed against the authorities of Ware on that account?—At that point there is a stream which enters the river, and it flows very rapidly there from the Town Mill of Ware, and the rapidity with which the water comes down clears away the bank, or the accumulations which are continually growing there; now and then there must be large accumulations in the river, but they are distributed over a large area.

4416. You would probably find it difficult to bring the matter home to the authorities of Ware?—Yes.

4417. (*Professor Way.*) And perhaps you could not do so until the evil had been the cause of some damage?—No.

(*Mr. Beardmore.*) I may mention that the river also, besides the millstream, has very large floods constantly coming down, and the mud gets washed away into the general stream; there is a very large amount of mud in the river generally, but not at that point.

4418. (*Chairman to the witness.*) Have you looked with any care at the recent Conservancy Act for the Thames?—Not with any very great care, but I have read it through.

4419. I suppose, if a complaint was made before any properly constituted tribunal that the river Thames was polluted by the river Lee, you could not deny it?—Unquestionably not; our great complaint is that pollution does find its way down our channel, but we have not sufficient power to prevent it.

4420. You might say that you do your best to prevent it, but you must at the same time confess you were guilty of passing the foul water into the Thames?—The fact is that our funds are not applicable to the purpose of preventing it. By their prescriptive rights the parties have been empowered to discharge, and from time immemorial discharges have taken place at different points of the river, and the law will not reach them in its present state unless they cause a nuisance.

4421. I suppose you are aware that if any person suffers from a nuisance caused by pollution from sewage, and he can prove that he suffers from it, the person who causes the nuisance can be indicted?—Quite so.

4422. We have been informed that it is by no means a simple process to obtain an injunction to restrain parties from causing a nuisance?—It is a very expensive and tedious proceeding.

4423. And when you have obtained an injunction you are sometimes no better off than before?—That is frequently the case.

4424. You may be suffering in the river Lee from town sewage, and if you obtain an injunction you may be no better off than you were before?—An injunction may be only partial in its operation, for instance, you might proceed against a board, having certain limits to its jurisdiction, and not extending over the whole area of the nuisance, and you would have to multiply your legal proceedings with very doubtful success.

4425. Are you aware that the river Lee Trustees are not alone liable to these almost futile proceedings, but that the authorities of towns and private individuals stand in the same position?—Quite so.

4426. Suits may be multiplied without any beneficial results being attained?—Yes.

4427. Have you considered the question of the future conservancy of the river Lee, and what form it might take in connexion with your trust?—I have thought a good deal about it, but I do not know whether I ought to express an opinion in the presence of the chairman, who is prepared to speak upon that subject.

4428. Will you then, as far as you can, enumerate the nuisances which exist between Ware and the point at which the East London Water Company take their water?—At Ware there are a great number of privies and drains which lie immediately over the river and which are discharged immediately into it; in a space of only about 200 yards there are a great number, about which we have complained, but we

found that the Local Board of Health were not disposed to act in the matter.

4429. If you summoned those parties before the justices I suppose their advocate would say that they had a prescriptive right?—Yes, and that is the difficulty we have to contend with. The next bad nuisance is at Tottenham; I think there is nothing between Ware and Tottenham of any importance. There is a small amount of drainage from the towns and villages.

4430. (*Mr. Harrison.*) Is the sewage of Hoddesdon carried into the river?—Yes, it is partially.

4431. Between Ware and the point from which the East London Water Company take their water are there any streams or tributaries from which any polluted water is passed into the Lee?—Yes, there is the Stort, and I believe the whole of that is turned into the river Lee.

4432. Do you find in the navigation that the water of the Stort brings down much polluted matter?—It is not observable, and it is not in the form of solids; then there is Waltham Abbey.

4433. (*Chairman.*) Have you any legal power over the navigation of the river Stort?—None whatever.

4434. You have no legal authority to pass along that stream to inspect it and see what they are doing?—No, except as one of the public might, not in any official capacity.

4435. That stream is not under your supervision?—No.

4436. The owners have an independent engineer and an independent board, and I believe it is private property?—I believe so. After we leave Waltham Abbey we reach Enfield lock.

4437. Is there any discharge of sewage at Waltham Abbey which is objectionable?—Yes, it is very bad there.

4438. Then you get to Enfield lock?—Yes.

4439. Is the sewage from Waltham Abbey let into the Lee above the point at which the East London Water Company takes its water?—Yes.

4440. So that any foul matter that comes in there necessarily forms part of the water taken by the East London Water Company?—Certainly. The next place is Enfield lock; the outfall works are in that neighbourhood, and the drainage from that district finds its way into the Lee.

4441. Is there any treatment of the sewage matter by filtration before it gets into the river?—I think not, it is all in the natural state.

4442. Is it above or below the point at which the East London Water Company takes its supply?—Above; then we come below the point of the supply to the East London Water Company below Tottenham lock. There we had first an intercepting drain or outfall, and that was constructed by the East London Water Company in pursuance of an Act that was passed in 1852.

4443. To which I believe you assented?—Yes, we were assenting parties, and for this reason: the sewage before that had found its way into the river Lee, through open ditches and several outfalls that there were into the Lee, in a worse form altogether than that in which it presents itself now. Those ditches were intercepted to enable the East London Water Company to take their supply wholly above Tottenham lock as pure as they could get it, and they passed the intercepted sewage down at the tail of Tottenham lock. I might say that it is not so bad as many I have spoken of, as the sewage is conveyed for some miles in an open drain, and absorption, evaporation, and oxidation have been going on, so that when it arrives at the Lee it is not always very polluting in its character. In hot weather it is so certainly.

4444. (*Mr. Harrison.*) The whole drainage of the land adjoining is intercepted as well as the sewage, is it not?—Yes.

4445. So that the sewage is diluted to a considerable extent?—Yes.

4446. I believe there are some tributaries as well?—Yes, at that point there is a considerable silting up of the bed of the navigation by the effluent water and the matters in solution.

4447. If the sewage matter running down the cut becomes comparatively harmless when it gets to the bottom, what is the effect upon the inhabitants of the district through which it runs?—They complain very much of it. I do not know that there is a very manifest effect produced, but there must be something. Then about a quarter of a mile below the intercepting outfall comes the whole drainage of Tottenham, Wood Green, and West Green.

4448. At Tottenham they profess to disinfect the sewage?—They attempt to do it, but the result, I believe, is utter failure.

4449. Do you think that the process is less effectual than that pursued at Hertford?—Certainly; because the Hertford arrangement is adequate to the volume of the sewage, whereas at Tottenham it is totally inadequate.

4450. You think that they do not take out the amount which they might?—Certainly; not a tenth part of it.

4451. Have you given them any notice that you should interfere with them?—We have filed an information against them in chancery.

4452. There are several places besides the lunatic asylum at Colney Hatch, all of which tend to pollute the Lee at and about Tottenham?—Yes.

4453. I believe that the Tottenham board have either threatened or commenced proceedings against certain parties above them?—Yes, they have attempted to do so. I believe last year they filed a bill against the Hornsey board, but there there is nobody to make amenable; that board is not an enduring body; it is not a corporation.

4454. (*Professor Way.*) The works at Tottenham, I believe, were made 12 years ago?—Yes; rather more.

4455. Has the population of Tottenham increased since that time?—Yes, very largely, but the works have not been increased.

4456. Do you think that that is the cause of their inadequacy?—Yes, I believe that the works have been, although in operation, decreased; that is to say, certain tanks that were in operation originally have been abandoned.

4457. I believe there were certain elevated tanks into which the sewage was lifted, and I think those have been abandoned?—Yes. As I understand the process, it involved the use of those tanks to enable them to deal with a larger volume of sewage than they now deal with.

(*Mr. Beardmore.*) They also had filter-beds in a yard, which have all been filled up.

4458. (*To the witness.*) Was it at the suit of the Trustees of the river Lee that the interim injunction was granted?—Yes; and it was to restrain the authorities of Tottenham from bringing the sewage of Wood Green and West Green into the Lee. The injunction says that they shall not increase the evil until the hearing of the cause.

4459. Was it in consequence of that, that they made cesspools in Wood Green?—I do not know; but I might mention that on the occasion of the last survey of the river, (there is an annual visit paid by the Trustees of the river to inspect the works,) we went to the deodorizing works, and we there saw the pollution passing into the river at Tottenham, below the lock, and the nuisance was then excessive, the sewage was perfectly black and abominable. That was after the institution of our suit.

4460. Have you any control over the drainage of the adjoining lands on either side of the river Lee?—No.

4461. Or any responsibility—for example, if any flooding takes place are you liable for the damage done?—I presume that if damage arose from the want of repairs and the inefficient working of the navigation there probably might be some liability, supposing that the banks were not kept up and made sufficiently strong.

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4462. (*Mr. Harrison.*) Are there any water-marks on your navigation to which you are limited as to the height at which the water is to be kept?—There are marks up to which we are entitled to keep the water for the purposes of the navigation as against other parties, but we are not limited as to any outlay that may be necessary for the preservation of our works; we have proper side weir exits for the water. Then I come to the state of the river from Old Ford to the Thames, which is the tidal portion of the navigation, and that is rendered very pestiferous during hot weather owing to the discharge of impurities from various manufactories and works on the banks of the river there.

4463. Have the Trustees any control over those works either to prevent their establishment or to regulate them when established?—Not unless they interfere with our banks, or they require lay-byes or works and convenience; we have no power if they keep themselves at a distance from our undertaking. We find that they generally come to our banks, and then make application for an agreement for lay-byes or for a supply of water to their engines; then they come under our control in some respects.

4464. Have applications been recently made to you for leave to make wharves for the accommodation of the traffic on the banks of the river in the navigable parts?—Yes, one was made very recently at Ponder's End; large jute works are being erected there.

4465. So that they should be enabled to have their barges come alongside and discharge their loads at the wharves?—Yes, and the agreement is in course of completion. In every case when we enter into an agreement of that kind we invariably insert clauses to restrain parties from casting any pollution into the river; we make that a *sine qua non*, and we will not grant them the facilities they require unless they under take to exclude all sewage and drainage from the navigation.

4466. Have you made any arrangement with any of the boards of health or other authorities, either of London or any of the adjoining parishes in the tidal portions of the river, to prevent sewage passing in?—No.

4467. Is it not the fact that a considerable amount of sewage has been passed in from the London district to the western side?—Yes.

4468. Have you any sewage passing in from any of the areas on the eastern side; I believe there is no sewer?—I think not. Not in the Limehouse Cut, but there is the West Ham sewage which is discharged beyond the Bow Creek entrance. There are two entrances to the river Lee navigation, one *viâ* Bow Creek to Blackwall, and the other from Bromley to Limehouse, near the church, and up the canal which was constructed under the powers of an Act of Parliament.

4469. That, I think, brings you down to the Thames?—Yes. We then come within the district of the Metropolitan Board at Old Ford, and there are outfalls, what they call storm water outlets. Three or four years ago, I think in 1863, the discharge from those outlets was so enormous that the Trustees were compelled to take proceedings, and they filed an information and bill against the Board and they obtained an injunction and 820*l.* in respect of the damage done to the navigation, and the costs of the suit.

4470. The metropolitan board allowed their sewers to discharge at their overflows as you conceived improperly?—Quite so, and the court justified our view of the question.

4471. I assume that having made overflows at those points they would have power to admit the flood water under certain conditions?—Undoubtedly. The injunction that was obtained is permanent, and since then they have constructed their main outlet works at Barking, so that we do not now anticipate such an influx under any conditions as we had then.

4472. Did the nuisance take place previously to the time when they commenced their outlet works at Barking?—Yes.

4473. They had made a temporary outlet then?—Yes.

4474. (*Professor Way.*) Have they not an overflow at Bow Lane?—I think not.

4475. Does Bow Common drain into the Lee?—No.

4476. You know that there are all sorts of disgusting trades carried on there?—It is a nuisance district.

4477. Does it drain into any stream which drains into the Lee?—I would rather that Mr. Beardmore answered that.

(*Mr. Beardmore.*) It was the ancient Tower Hamlets sewer up to about the 13th of August last. It flowed under the river Lee by a pipe, but there was a storm overflow under Bow Common bridge, which I think is what you refer to; if heavy floods of rain came it flowed over into the Lee, but only on those occasions. On or about the 13th of August the metropolitan board commenced pumping temporarily at Abbey Mills from the low-level sewer, and since that date I believe the bulk of the sewage of that sewer has been turned into the low-level sewer, not because it happened to run into the Lee, where it overreached it, but it ran down into Limekiln Dock, and created an abominable nuisance at Limekiln Dock; that nuisance is very much mitigated.

4478. (*Mr. Harrison.*) When was that abominable nuisance which you speak of?—Up to August it had always prevailed.

4479. You know that of your own knowledge?—Yes. Perhaps I may explain that the nuisance of the Tower Hamlets sewer at Limekiln Dock was very much mitigated when the northern high-level sewer was carried to Barking in the summer of 1863, but the sewage has flowed ever since up to very recently, when it was diverted under the circumstances which I have mentioned, and it is now pumped by temporary engines into the high-level sewer, and so to Barking.

4480. (*Professor Way.*) The Penstock Station was the point which I meant.

(*Witness.*) The storm outlets of which I have been speaking are connected with that Penstock Station, and I may say that the repetition of that nuisance is possible, according to the construction of their works.

4481. Because they have a permanent outfall?—Yes.

4482. It could only, I believe, be possible in a very heavy storm?—I believe that to be so because the gates are set at a very great height.

(*Mr. Beardmore.*) Up to August the low part of the Hackney brook came by gates which are shut down. The arrangements are very complicated; it is hardly possible to explain them or to understand them without a plan and section.

(*Witness.*) We have recently had occasion to complain of what we thought was the inflow of a quantity of sewage from those outlets; there was no diminution in their flow at Barking Creek on the day of which we complained. The outlets are probably a quarter of a mile off, that is to say, the entrance into the Lee is a quarter of a mile from Penstock, and their theory is, that this quarter of a mile must from time to time have accumulated animals and refuse, and that when there was a flood of rain in London it ran over the gates, and simply pushed out the impurities which had flowed up these channels by the action of the wind. If that be the case there must be some preventive means; there must be a grating or something of that kind placed at the mouths to prevent its occurring again. The rust shows that the gates have never been touched for two or three years.

4483. (*Mr. Harrison.*) Is the mill property and the land which the navigation Trustees possess a security for the money which you have borrowed?—Certainly, we consider so.

4484. Are you aware that upon the Thames, the Thames Commissioners had land to the value of about 10,000*l.*, which was not considered security for the bondholders?—I conceive that their bond must have

been in a different form. We certainly understand that the whole undertaking is a security for the monies advanced. We have actual power to buy, hold, and dispose of lands.

4485. In the case of the Thames the Commissioners at any rate actually possessed land valued at about 10,000*l.*, which they said was not available for the payment of the bondholders. Your debentures appear to be terminable at short dates?—At periods of three, five, or seven years.

4486. Is that provided for in your Act of Parliament, or is it an arrangement of your own?—It is an arrangement of our own. We are not limited at all as to time.

4487. You might have the money for an unlimited period of time as the bondholders determined?—Quite so, for a shorter or a longer period as circumstances might admit. I am reminded that we have been a corporate body since 1850, under seal, and as such corporation we are able to hold lands and to dispose of them, but the Commissioners of the Thames were never in that position, so that we are superior to that body in that respect as well as in the other respects which I have mentioned.

4488. The money which is annually paid by the water companies to your Trustees is on account of powers given for the abstraction of the water from the river Lee?—Yes.

4489. Besides that have they not power to call upon you to execute works, they paying for them?—They have, for the better storage of the water.

4490. Have they exercised that power?—In one instance; the New River Company called upon us last year to reconstruct the Hertford lock. The reason was that they drew down the water frequently, as we proved by gaugings, considerably below the navigable head; they did so from time to time. We made complaints to them and threatened them with proceedings because our barges ran aground and did not get over the sill at Hertford lock. Then they said, "Well, in order to prevent your having any cause "for complaint we will ask you to rebuild your lock "and to place the sill at a lower level;" and that has been done, and we have had no further complaint from the traders on the navigation.

4491. You have benefited the navigation and you have improved the construction?—Yes, and they have kept up their water very much better since the lock has been lowered than they did previously.

4492. Shall we obtain from your manager information as to the advantage which the navigation is, not only to Hertford but to the whole district through which it passes, or have you any observations to make upon that head?—My own impression is a very strong one, that the navigation is very essential to the towns through which it passes as a highway. I moreover think that the navigation should be maintained in a sanitary point of view, because the form of a river well maintained and in good repair, the river being full and deep, must be better for the health of the districts than a river neglected and simply running as a channel for the passage of water. Barges passing to and fro causing a change of the water from pond to pond, locking every hour, I fancy, must be more beneficial than a river neglected.

4493. Does the navigation afford greater facilities for manufactories upon its banks than can be given by any railway?—Certainly. There are manufactories on the banks which have no other mode of carriage.

4494. Barges upon a navigation can stop at any point?—Yes.

4495. It is not so easy for the trucks to do so upon a railway?—Just so. There are a number of public wharves upon our navigation, and if they were abandoned it would be a very serious loss to the neighbourhood.

4496. (*Chairman.*) Do you charge a toll for carrying manure?—No.

4497. Then I presume that that is an advantage to the landowners and the farmers?—Quite so. Agricultural manure is not charged for, and that alone must be an immense advantage to the Londoners who purchase an enormous quantity.

4498. (*Mr. Harrison.*) Is artificial manure free?—Yes. If you will allow me to refer to the clause in the Act which exempts those articles you will see what is included. It is the seventh of George III., chapter 51, section 81, "Provided always, that no tonnage "rates or duties shall be due, paid, or demanded for "any boat, barge, lighter, or other vessel carrying "only oil-cakes, malt dust, pigeon dung, or manure "of any kind whatsoever on the said river or the said "new cuts or canals or any of them, or any part "thereof."

4499. So that the agriculturists on each side of the river throughout the whole length of the navigation have a beneficial interest in the maintenance of the navigation?—Unquestionably. There is a very large brickfield at Ware which has no other means of carriage except the road.

4500. (*Chairman.*) What is your present income and what rate of increase has taken place?—That, I think, will be best manifested by the traffic return, which will show it year by year.

4501. Is there anything further which you would wish to name to the Commission?—I think not, except that I will complete my list of Acts.

The witness withdrew.

Appendix No. 1. to Evidence of John Marchant, jun., Esq., Clerk to the River Lee Trust.

Statement (referred to supra, Question 4330) of Matters relating to the River Lee Navigation.

Constitution and Statutory Powers of the River Lee Trust.

stitution.

The navigation of the river Lee is managed and governed by a public trust, incorporated by the name of "The Trustees of the River Lee."

They derive their powers from various Acts of Parliament, the earliest of which were passed in the reign of Henry VI., one (cap. 5.) in the third year of his reign, (1424); and the other (cap. 9.) in the ninth year of the same reign (1430).

en. VI., c. 5. (1424.)
en. VI., c. 9. (1430.)

These two statutes empowered the Chancellor for the time being, to issue commissions for the purpose of clearing, scouring, and amending the river "Ley," which in both of them is stated to be "une des grandes rivers" of England.

The river appears to have been rendered navigable in the reign of Queen Elizabeth, and the constitution of the River Lee Trust, may be said to have been first established in that reign.

Eliz., c. 18. (1570.)

In the thirteenth year of Elizabeth (1570), an Act was passed (cap. 18.) "For the bringing of the river of Lee, to the north side of the city of London." By this Act the Lord Mayor, Commonality and Citizens of London, and their successors, were authorized to bring the said river of Lee from the town of Ware to the north side of the city of London, and by section 4. it was enacted, "That the said "Lord Mayor, Commonalty and Citizens, shall have the "whole jurisdiction, conservice, rule, and government as "well of the said New Cut River and ground of each side, "as also the royalty of the fish and fishing of the same, and "the profits of the said ground, soil, and water to them "and their successors for ever." Power was also given by this Act for the punishment of offenders and persons breaking the rules and orders provided for the preservation and maintenance of the said river.

The Lord Chancellor or Lord Keeper of the Great Seal of England was empowered to appoint and authorize by commission under the Great Seal of England, sixteen Commissioners, (namely four of the city of London, and four of each of the shires of Essex, Middlesex, and Hertford, having lands, tenements, or hereditaments of the clear yearly value of forty marks, and not being London traders,) who should have full power to treat, agree, and compound for the scouring, cleansing, repairing, and keeping of the said river Lee.

The navigation between the towns of Hertford and Ware was at this period under the control of the corporation of Hertford, but certain disputes arose between that body and the inhabitants of Ware and the New River Company as to the jurisdiction of those bodies, and in consequence of these

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disputes an Act was passed in the twelfth year of the reign of George II., cap. 32. (1739.) "For ascertaining, preserving, and improving the navigation of the river Lee from the town of Hertford to the town of Ware in the county of Hertford; and for preserving and improving the said river from the said town of Ware to the New Cut or River made by the Mayor, Commonalty and Citizens of London; and for enabling the governor and company of the New River the better to supply the cities of London and Westminster, and the liberties and suburbs thereof, with good and wholesome water."

12 Geo. II., c. 32. (1739.)

By this Act the course of the river was defined, and certain persons therein named were appointed for the putting in execution the powers and trusts by them reposed by virtue of and in pursuance of that Act for the purposes therein expressed.

7 Geo. III., c. 51. (1766.)

In the seventh year of the reign of George III., cap. 51. (1766) another Act was passed, "For improving the navigation of the river Lee from the town of Hertford to the river Thames; and for extending the said navigation to the flood gates belonging to the town mill in the said town of Hertford."

By this Act the trustees appointed by the 12th George II., cap. 32., together with several other noblemen and gentlemen therein named were appointed, "Trustees for the making, extending, improving, and maintaining the navigation of the said river Lee, from the flood gates belonging to the town mill in the town of Hertford to the river Thames, and for putting this Act in execution;" and they were empowered to cleanse, scour, deepen, enlarge,

7 Geo III., c. 51, sec. 1.

or straighten the channel of the river Lee, and to make and maintain the new cuts therein described, and to build the bridges and works therein mentioned. (Section 1.)

Sec. 69.

By this Act the navigation was declared to be a free navigation for all the King's liege people, subject to the payment of such rates and duties which were thereby authorized to be levied.

Sec. 80.

The main source of revenue of the trust is provided by this Act which defines the tolls to be taken upon the navigation in respect of the commodities conveyed upon it.

9 Geo. III., c. 58. (1778.)

The trustees were authorized by the 19th George III., cap. 58. to raise certain additional tolls therein described.

45 Geo. III., c. 69. (1805.)

Another Act was passed in the 45th year of the reign of George III. (cap. 69), for the better preservation and further improvement of the navigation, defining certain heights of water, and giving power to the trustees to make byelaws

Sec. 10.

for regulating the lading of barges.

Sec. 12.

It was also provided that no craft should carry more than 40 tons of freight, but this provision has since been repealed by the Act next to be referred to.

13 & 14 Vic. c. 109. (1850.)

The next Act was passed in the 13th and 14th years of the reign of Queen Victoria (cap. 109), called "The Lee Navigation Improvement Act, 1850." The principal objects of this Act were to enable the trustees further to improve the navigation, and to dispose of the surplus water.

Sec. 8.

The trustees were incorporated by the name of "The Trustees of the River Lee," and were empowered to purchase and hold, and sell, demise, and dispose of lands for the purposes of that and the therein recited Acts.

18 & 19 Vic. c. 196. (1855.)

In 1855 arrangements for the supply of water to the New River and East London Waterworks Company were confirmed by the Act of 18 & 19 Victoria, cap. 196. "The River Lee Water Act, 1855."

Sec. 9.

By this Act the surplus water of the Lee, over and above the quantity required for the purposes of navigation, was vested in "those two companies respectively, subject nevertheless to such rights as might not then belong to the trustees."

Sec. 11.

The daily quantities of water reserved to the trustees for navigation purposes, and not subject to any control by the companies, are as follows:—

First. They may pass through their locks from the highest point at which the companies or either of them take their supply, down to and including the first lock above Feilde's weir (called "The Upper Reach"), not exceeding in any 24 hours 576,000 cubic feet.

Secondly. They may pass from the first lock above Feilde's weir exclusive down to and including Waltham town lock (called the Middle Reach), not exceeding in any 24 hours 720,000 cubic feet.

Thirdly. They may pass from Waltham town lock exclusive down to and including Old Ford lock (called the Lower Reach), not exceeding in any 24 hours 864,000 cubic feet.

All water below Tottenham mill, not required by the two companies at their drawing stations, is reserved to the trustees for navigation purposes.

Sec. 27.

The two companies are strictly forbidden, without the consent of the trustees, at any time to draw from the river so as to reduce the water in any pond of the navigation below the customary head level of that pond.

Sec. 30.

The priorities of rights to take the water of the river Lee are very clearly defined by this Act, and are as follows:—

First. The right of the trustees to the upper middle and lower daily quantities, and such further quantity as shall be necessary to maintain the water of the navigation on a level with the head levels aforesaid.

Secondly. The right of the New River Company to take 2,500 cubic feet a minute.

Thirdly. The right of the East London Waterworks Company to take 2,500 cubic feet a minute.

Fourthly. The right of each company to take *pari passu* 500 cubic feet a minute.

Fifthly. The right of each company, after notice, to take *pari passu* any additional quantity.

Sixthly. The right of the trustees to surplus water below Tottenham mill.

The body of trustees consists of the following *ex-officio* members, viz.:—

12 Geo. II sec. 16.

The Lord Mayor, Aldermen, and Recorder of the city of London for the time being; the Knights of the Shire for the county of Middlesex, the Members of Parliament for the city of Westminster, the Knights of the Shire for the counties of Essex and Hertford, the Members of Parliament for the boroughs of Colchester and Hertford; the Mayor of Hertford for the time being; and noblemen and gentlemen from time to time elected from the counties of Hertford, Essex, and Middlesex.

The governor, deputy-governor, and treasurer of the New River Company for the time being are also *ex-officio* members of the trust.

7 Geo. III sec. 1.

The trustees have, in execution of their powers, made new cuts and straightened the course of the navigation; they have removed locks and other obstructions; they have replaced old wooden locks with new brick and stone structures; and have otherwise expended very large sums in maintaining and improving the navigation between Hertford and London.

By the foregoing Acts the whole jurisdiction, conservice, government, and maintenance of the navigation of the river Lee has been for three centuries and is now vested in the trustees appointed under those statutes.

The trust has been regarded as one of great public importance, having for its sole object the public benefit and advantage.

Nuisances on the Navigation.

Hertford.

Commencing at Hertford there are but few cases of drainage into the river Lee, the town being sewered by the New River Company in order to purify the source of their supply below Hertford lock, the first on the navigation.

The sewers constructed by that company intercept the drainage of the town, and convey it to deodorizing works about a mile down the valley towards Ware. The sewage water after being dealt with at the works is conveyed down an open channel into the river Lee below Ware lock, about two miles south of Hertford, and just above the town of Ware.

The discharge from this channel, called the "Manifold ditch," is not generally offensive, but in the summer months during the prevalence of hot weather it is said to be so.

Communications upon the subject have passed occasionally between the Ware local board of health and the trustees of the river Lee, but the local board have the power in their own hands to deal with the nuisance if it be one.

Ware.

Within 500 yards of the Manifold ditch and discharging into the same pond of water is the outlet of the main sewer of the town of Ware, under the control and management of the local board of health. The sewage flows into the navigation in large volumes, and without any attempt being made to deodorize or purify it. A trap door is fixed at the mouth of the sewer, opening outwards by the action of the sewage.

This Ware sewer is undoubtedly a great nuisance to the navigation, and the neighbourhood of the outfall, and is one which calls for interference.

Another sewer flows into the navigation under Ware bridge, and takes the drainage of Amwell End. There is no attempt to purify the discharge of this drain.

In addition to the above, there are many privies and drains discharging into the river at Ware.

Stanstead.

There is no sewer falling into the river at Stanstead, but there are privies and drains which should be done away with.

Tottenham

There is no further serious drainage into the navigation below Ware until we reach Tottenham.

The East London Waterworks Company take their supply of water from the river above Tottenham lock.

In about the year 1853, that company constructed an intercepting drain or sewer, to intercept and divert the drainage and sewerage water from Enfield, Ponder's End, and Upper and Lower Edmonton, and part of Tottenham.

Previously this drainage found its way into the navigation through open and circuitous ditches, discharging into the river above Tottenham lock. The intercepting drain was made under the powers of the East London Waterworks Act, 1852, 15 & 16 Vict., cap. 164, (sec. 81).

It has its outfall into the Lee a few yards below Tottenham lock.

When this intercepting drain was constructed the discharge from it was comparatively innocuous, but the increase of population in the districts draining into it has caused a corresponding increase in the volume of discharge which is at times offensive. Large quantities of sewage, mud, and sand are also deposited in the bed of the Lee from the drain.

About a quarter of a mile down the river below the East London drain is an intolerable nuisance, caused by the discharge through an iron pipe into the navigation of the sewage of Tottenham, Wood Green, and West Green by the Tottenham local board of health. In hot weather the water in the neighbourhood of and for some distance below the outfall is black with filth, and the smell is most offensive.

The navigation is also injuriously interfered with by the deposit of mud along its bed.

The trustees of the river Lee have found this nuisance so intolerable that they have been compelled to file an information and bill of complaint in the Court of Chancery. An order has been obtained and is still in force, restraining the Tottenham board from making any further connexions with houses and drains until the hearing of the cause, which will be argued during next term.

ld Ford, Bow, ad Limehouse ut.

The state of the river from Old Ford to the Thames, which is the tidal portion of the navigation, is rendered very pestiferous during hot weather, owing to the discharge of impurities from various manufactories on the banks of the river there.

The Limehouse Cut is at times little better than a reeking ewer.

The trustees have endeavoured to prevent the increase of the nuisances there, but owing to the want of statutory and summary powers have only been very partially successful.

The Metropolitan Board of Works have constructed large storm-water outlets from their works at Old Ford, and in the year 1863, the discharge from these outlets was so enormous that the trustees were compelled to file an information and bill in Chancery, the result of which was a decree by the court, restraining that body from continuing the discharge, and directing the payment by them of 820*l.* in respect of the damage to the navigation by the deposit of the solid sewage in its bed, together with the costs of suit.

The mode of construction of the Metropolitan works is such as to render the repetition of this nuisance possible.

The trustees endeavoured to deal with the cases in the Limehouse Cut, but could get no relief for want of summary powers. On applying to the Thames Conservancy, who have jurisdiction over three miles of the river for nuisance purposes, that body attacked some of the cases, and obtained convictions on the evidence supplied by the officers of the trust.

This part of the river will be relieved of the drainage now discharged into it on the completion of the Metropolitan low-level sewers, which will intercept the drains of that locality.

Financial Position of the Trust.

evenue.

The trust derives its income from the tolls levied upon commodities carried upon the river; from certain annual payments for water supplied to the New River and East London Water Companies; and from the rentals of mills and other properties belonging to the trustees.

The whole revenue of the trust, from whatever source arising, is vested in the trustees, to be applied in paying the several annual payments directed to be made by the 7th Geo. III., c. 51; in paying interest upon money raised under their borrowing powers; and in improving and maintaining the navigation.

The estimated annual receipts are as follows:—

Tolls	£11,611
Water rents	3,500
Rentals of mills and other property	1,401
Sundries, including ballast	700
	£17,212

The estimated annual payments are as follows:—

Salaries	£1,300
Pensions	430
Lock-keepers' and collectors' wages	1,345
Maintenance and repairs, including materials	3,500
Mills and weirs	800
Land rents	180
Rent and taxes	600
Insurances	15
Printing, stationery, and advertising	165
Office disbursements	160
Sundries	97
Expenditure for maintenance	8,592
Interest on borrowed money, viz.:—	
Debenture loan 7,173	
Other loans 1,250	
	8,423
	£17,015

Capital. 2,630 = 4½ 4,543 = 5 — 7,173.

The amount raised on debentures under the borrowing powers of the trust is 149,287*l.*, viz., 58,412*l.* bearing interest at 4½ per cent., and 90,875*l.* at 5 per cent. In addition, the bankers have advanced 23,000*l.*, and the London Life Assurance Association the balance of a loan of 20,000*l.*, 2,000*l.*

The capital raised, therefore, stands thus:—

Debenture loan	£149,287
Loan from bankers	23,000
Ditto London Life Association	2,000
	£174,287

The trustees are empowered to raise the sum of 230,000*l.* upon the credit of the trust, so that their borrowing powers are unexhausted by the sum of 55,713*l.*

Progress of trade.

The progress of the traffic may be understood from the following statement, which shows that the income from tolls has nearly doubled itself within the last 15 years, viz.:—

	£
Tolls received in 1851	5,798
„ 1852	6,266
„ 1853	7,852
„ 1854	7,482
„ 1855	8,010
„ 1856	8,647
„ 1857	8,670
„ 1858	8,104
„ 1859	8,444
„ 1860	8,929
„ 1861	9,202
„ 1862	10,526
„ 1863	10,290
„ 1864	10,057
„ 1865	10,431

APPENDIX No. 2 to EVIDENCE of JOHN MARCHANT, Jun., Esq., Clerk to the River Lee Trust.

Copy of Notice to remove Nuisances given by the direction of the River Lee Trustees.

HERTFORD,
August 1864.

SIR,

At the annual inspection of the river Lee on the 2nd inst., the Trustees observed that considerable nuisance was occasioned to the navigation by the drainage from your into the River.

It is the imperative duty of the Trustees to preserve the river from contamination; I am therefore instructed to request that you will accept this as a notice to remove the cause of complaint from your premises without delay.

The next meeting of the Trustees will be held on Saturday, the 20th instant, by which time they hope to hear from you that you are taking active measures to comply with their requisition.

Your obedient servant,
JNO. MARCHANT,
Clerk to the Trustees.

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Mr. J. Marchant, jun.

19 Dec. 1866.

Appendix No. 3 to Evidence of John Marchant, jun., Esq., Clerk to River Lee Trust, (referred to infra, Question 4829).

Abstract of the Receipts and Payments of the Trustees of the River Lee, for the Year ending 31st December 1866.

Receipts.

		Ordinary. £ s. d.	Extraordinary. £ s. d.
Tolls		11,581 5 0	
Water rents		3,441 13 4	
Sundry rents		1,060 11 10	
Loans, namely:—			
Upon debentures	£14,500 0 0		
Less debentures paid off	6,944 11 10		
		-	7,555 8 2
Sundries		412 2 7	
Ballast sold		298 4 4	
Repayments for sundry works		169 18 0	
Received from the New River Company on account of the reconstruction of Hertford lock		-	1,889 10 1
Purchase of property		-	115 0 0
		16,963 15 1	9,559 18 3
			16,963 15 1
			26,523 13 4
Balance of 1865 account			1,530 18 1
			£28,054 11 5

Payments.

		Ordinary. £ s. d.	Extraordinary. £ s. d.
Interest		8,558 11 11	
Salaries		1,353 15 0	450 0 0
Pensions		423 10 0	
Lock-keepers' and collectors' wages		1,352 13 0	
Maintenance and repairs of locks, weirs, works, plant, and dredging		1,501 4 6	
Materials for ditto		250 2 11	
Reconstruction of Limehouse lock		-	3,115 8 4
Payments on account of ditto, viz.:—			
Materials	£3,294 0 4		
Limehouse board of works	440 2 2		
Gas	32 8 5		
Compensation to tenants	165 10 0		
Watching	38 7 4		
Munday—Supervision of works	196 5 0		
Rent of warehouse	52 0 0		
		-	4,218 13 3
Reconstruction of Hertford lock		-	1,889 10 1
Mills and weirs		784 11 8	
Land rents		158 17 7	
Rents, rates, taxes, &c.		639 2 10½	
Insurances		1 1 0	
Printing, stationery, and advertizing		93 2 8	54 2 9
Office disbursements		113 15 0½	
Sundries		82 7 3	
Stamps on debentures		-	17 8 3
Commission on loans		-	122 0 0
Purchase of property		-	94 10 0
Law expenses		-	115 18 2
Parliamentary expenses		-	536 0 9
Engineers' ditto		-	251 7 0
Ballast paid for		78 7 0	
		15,391 2 5	10,864 18 7
			15,391 2 5
Balance of banker's cash, 1866		1,757 8 9	26,256 1 0
Ditto, office cash		41 1 8	1,798 10 5
			£28,054 11 5

At the annual general meeting of the trustees of the River Lee, held at the London Tavern, Bishopsgate Street, in the city of London, on Wednesday, the 6th day of February 1867, the above abstract was submitted to, and settled and passed by, the trustees assembled at such meeting.

(Signed) Gascoyne Salisbury, Chairman.

Statement of Traffic upon the River Lee Navigation during the last 21 Years, from 1846 to 1866.

Year.	Tons.	Tolls. £	Year.	Tons.	Tolls. £
1846	287,327	8,249	1857	274,741	8,670
1847	313,304	8,455	1858	254,269	8,104
1848	287,166	8,349	1859	280,353	8,444
1849	287,520	8,511	1860	275,667	8,929
1850	265,158	7,844	1861	300,900	9,202
1851	212,633	5,798	1862	355,519	10,526
1852	206,213	6,266	1863	320,850	10,290
1853	228,072	7,852	1864	351,038	10,057
1854	216,930	7,482	1865	349,760	10,431
1855	257,886	8,010	1866	393,788	11,581
1856	287,337	8,647			

Comparative Statement of Traffic.

	Tons charged.	Tons. £
Tons carried and tolls collected in the year 1866	393,788	11,581
Average per annum of tons carried and tolls collected in 15 years, 1846 to 1866, inclusive	262,305	7,974
Increase above the average in 1866	131,483	3,607

APPENDIX No. 4 to EVIDENCE of JOHN MARCHANT, jun., Esq., Clerk to the River Lee Trust, referred to infra, Question 4829).

Statement of Balances on "Ordinary" or Revenue Accounts for 10 years, from 1856 to 1865 inclusive, as shown by the foregoing Abstracts:—

	£ s. d.	Surplus. £ s. d.	Deficiency. £ s. d.
1856. Receipts,	11,472 10 2		
„ Payments,	11,640 3 11		
		- - -	167 13 9
1857. Receipts,	12,525 4 5		
„ Payments,	11,503 16 10		
		1,021 7 7	
1858. Receipts,	11,743 12 8		
„ Payments,	11,757 15 2		
		- - -	14 2 6
1859. Receipts,	12,934 3 7		
„ Payments,	12,271 9 0		
		662 14 7	
1860. Receipts,	13,204 0 9		
„ Payments,	13,497 12 10		
		- - -	293 12 1
1861. Receipts,	14,362 17 8		
„ Payments,	13,134 2 9		
		1,228 14 11	
1862. Receipts,	15,289 12 11		
„ Payments,	14,149 15 9		
		1,139 17 2	
1863. Receipts,	14,568 11 4		
„ Payments,	14,522 18 11		
		45 12 5	
1864. Receipts,	14,855 17 0		
„ Payments,	15,848 4 6		
		- - -	992 7 6
1865. Receipts,	16,064 1 1		
„ Payments,	15,497 4 5		
		566 16 8	
		£4,665 3 4	1,467 15 10
Surplus upon the operations of 10 years - -		- - -	3,197 7 6
			£4,665 3 4

The MARQUIS OF SALISBURY examined.

The Marquis of Salisbury.

4502. (*Chairman.*) I believe that your lordship is chairman of the River Lee Trust?—I am.

4503. How many years have you acted as chairman of that trust?—I think about 15.

4504. Will your lordship please to describe the character of the trust; it is I believe an unpaid trust?—Entirely.

4505. You pay your officers?—We pay our officers, but the trustees have no remuneration whatever.

4506. They meet at stated periods?—We generally meet once a month, and at additional times if requisite. We pass our accounts in London once a year, and generally we have the benefit of the attendance of some members of the corporation, and on other occasions they also come, it is principally when we meet in London during the session of Parliament.

4507. What number of trustees is required to make a quorum for business?—I think three, but we cannot sign any cheque without five.

4508. Is there at any time any difficulty in getting a quorum to do the business of the trust?—None. I do not recollect an instance of it.

4509. The gentlemen who are nominated you find quite willing to pay that attention to the duties which is necessary for carrying on the business of the trust?—Quite so.

4510. I presume that your lordship is well acquainted with the character of the district through which the river passes?—I may say that I am entirely acquainted with the river Lee. I do not say that I am well acquainted with all the tributaries, but I am entirely acquainted with the river Lee from Luton down to Bow Creek.

4511. Is the river Lee almost becoming what one might term a necessity to the district?—An absolute necessity.

4512. What amount of traffic in tonnage is now carried on the river Lee?—I have it from 1851 to 1865, for periods of three years at a time. The tonnage from 1851 to 1853 was 215,639 tons; the tolls were 6,638*l.* There has been a regular increase in the tonnage. From 1863 to 1865 it was 340,547 tons, and the tolls were 10,259*l.* The tolls in this year have been increased most prodigiously. I am not quite sure that I can state them correct, as the accounts are not made up; 11,073*l.*, has been received up to the 15th of December, which is more than we received in the previous three years.

His Lordship delivered in the following table:

RIVER LEE NAVIGATION.—AVERAGE STATEMENT of TONS carried, and TOLLS collected per Annum, taken from Periods of Three Years during the last Fifteen Years.

Years.	Tons.	Tolls.
1851 to 1853 - -	215,639	£6,638
1854 to 1856 - -	254,051	8,046
1857 to 1859 - -	269,784	8,408
1860 to 1862 - -	310,695	9,552
1863 to 1865 - -	340,547	10,259
Tolls received to 15th December 1866- -		11,073

4513. Any scheme which seriously affected the navigation of the river Lee would, I assume, perhaps in a greater proportion affect the value of property on both its banks?—Most certainly. Very much indeed.

4514. May we consider that the property situated in proximity to the Lee, on both its banks, may be said to exceed the navigation in value and consequently in interest if affected by anything done upon the river?—It would depend upon how far you carried it; but certainly the land is daily rising very much in value all along on both sides.

4515. There are towns situated upon the banks of the Lee and its tributaries?—There are. I am not acquainted with the Stort.

4516. Has the population in the valley of the Lee been increasing of late years?—Very much.

4517. Then, of course, the trade of the district would increase with the population?—Certainly.

4518. I suppose that the navigation upon the Lee is convenient, as it takes the goods more immediately to the premises of persons situate on either bank than any other mode of conveyance yet established can accomplish?—More so certainly, and to a greater extent; but I apprehend also that the carriage of goods on the Lee is very much cheaper than that on the railroads.

4519. We have heard that the river Lee trustees carry the manure without charge. I need scarcely ask the question whether any railway company gives the same facility?—Certainly not.

4520. Then it would be depriving the adjoining landowners of a sort of property into the possession of which they have come, if anything interfered with that arrangement?—I should certainly think so.

4521. Can your lordship give us a statement of the weight of manure which has been carried for any fixed periods?—I can. In 1858 there were 22,000 tons, and in 1863 there were 109,000 tons. In consequence of the cattle plague there was a great falling off in 1864 and 1865, because we ordered no manure to go down the banks. I rather took upon myself to order no manure to go down the banks during the cattle plague.

His lordship delivered in the following tables:—

RIVER LEE NAVIGATION.

STATEMENT of TRAFFIC to and from the various Points during Eight Years—1858 to 1865 inclusive.

	1858.		1859.		1860.		1861.		1862.		1863.		1864.		1865.	
	Tons.	Tolls.	Tons.	Tolls.	Tons.	Tolls.	Tons.	Tolls.	Tons.	Tolls.	Tons.	Tolls.	Tons.	Tolls.	Tons.	Tolls.
		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.
Limehouse Cut -	60,439½	1,164 17 11	67,808½	1,374 5 10	97,515	1,753 4 2	108,700	1,802 2 8	106,484	1,765 1 1	102,291	1,838 2 6	112,848	2,041 3 8	100,528	1,828 10 2
Duckett's Canal -	1,635½	29 7 4½	4,578⅓	84 12 10	2,729½	52 19 8	5,301	93 9 4	11,817½	222 11 5	10,988⅛	183 12 8½	28,496	449 3 0½	233,46¼	484 1 10
Homerton and Lee Bridge.	9,834⅓	266 19 3	8,993⅓	202 13 10	9,373½	201 4 1½	13,550½	293 17 8	13,702	415 1 6½	18,105	487 1 5½	30,794	730 6 5	42,849½	898 12 8
Tottenham and Ponder's End.	12,273¾	342 16 10½	8,671¼	241 4 7½	12,344¼	340 18 0½	14,707¼	408 3 4⅓	56,143½	1,121 11 6⅛	17,260½	671 19 7	20,131¾	531 8 0	21,499¾	553 2 1
Enfield Lock and Waltham.	22,296½	919 10 7¾	22,597¼	932 12 6½	24,128¼	1,004 8 1½	25,782	1,144 17 0½	23,378	1,204 2 4¼	21,181½	1,073 18 5¼	19,827	945 3 4½	19,673	907 3 2½
Cheshunt and Hoddesdon.	6,070¼	252 11 3	7,013¼	260 18 9½	5,678¼	205 17 7	6,655¾	246 7 5	7,503¼	282 2 4¾	7,883½	274 2 6½	9,192¼	249 10 2½	7,196	241 15 8
River Stort - -	45,407¾	2,037 0 2¾	43,499⅓	1,950 1 3¼	40,621	1,838 0 11	40,458½	1,817 12 4½	42,743¾	1,937 19 2½	46,489½	2,076 15 7½	44,937	2,038 3 1½	47,361¾	2,168 11 9¾
Rye and Stanstead -	5,528½	145 3 3	3,183½	130 17 2	4,886½	149 1 8	3,606¾	161 3 0	4,404¼	193 18 1	4,479¾	203 4 10½	4,023	169 19 8	4,350¾	190 5 7
Ware - - -	52,545¾	2,269 9 2¼	56,605¾	2,449 18 5	5,632½	2,419 18 10¾	65,358¼	2,567 3 8¾	71,321	2,650 16 9¼	73,422¾	2,710 8 11¼	63,355¾	2,179 0 4½	64,333	2,354 10 11½
Hertford - -	16,065½	676 14 8½	18,857¼	817 7 1⅜	21,768	963 16 11½	16,780¼	668 0 4¼	8,022	733 11 7	18,748¼	770 15 7¼	17,434	723 9 11	18,622½	799 13 11½
Total -	232,097½	8,104 10 8	241,808¼	8,444 12 5½	275,676¾	8,929 10 1½	300,900¼	9,202 12 4½	355,519¼	10,526 15 11¾	320,850	10,290 2 3¼	351,038¾	10,057 7 9	349,760½	10,431 7 11¼

River Lee Navigation.

Statement of Traffic during the last Eight Years.

Year.	Tons charged.	Tons of Manure and Spoil free.	Total Tons.	Tolls.
				£
1858	232,097	22,172	254,269	8,104
1859	241,808	38,545	280,353	8,444
1860	275,676	36,398	312,074	8,929
1861	300,900	40,967	341,867	9,202
1862	355,519	119,111	474,630	10,526
1863	321,850	109,974	430,824	10,290
1864	351,038	36,751	*387,789	10,057
1865	349,760	23,597	*373,357	10,431
Tolls received, 1st Jan. to 15th Dec. 1866				11,073

*The falling off in manure in the year 1864–1865 was caused by the prohibitory laws in consequence of the Cattle Plague.

4522. (*Mr. Harrison.*) In the first of those returns can your Lordship separate the weight of artificial manure from the weight of horse manure and London manure?—No.

(*Mr. Glass.*) The artificial manure is a very small proportion; guano and rape cake are the principal things; rape cake has to be certified that it is to be used for manure, and also ashes.

4523. (*Chairman to the Marquis of Salisbury.*) In speaking of carrying the manure free you mean that you permit the farmers or other persons interested, to traverse the navigation free of toll?—Exactly so; we are not carriers.

4524. You are not carriers in any sense; you have no boats of your own?—We have some for the purposes of dredging. I think that there is nothing else; we do not carry for hire but only for our own purposes.

4525. You do not enter into competition with carriers?—Not at all.

4526. You simply maintain the navigation, and levy toll upon persons using the navigation, and you regulate the traffic?—Yes.

4527. (*Mr. Harrison.*) I observe upon the railway a number of trucks between this and London laden with manure?—Yes.

(*Mr. Glass.*) The owners of that manure must pay the railway company for its carriage. When it comes down in small quantities, perhaps the land adjoins the railway and is at a distance from the navigation. Our navigation does not extend beyond Hertford, and perhaps those trucks may be going further down, to Cambridge.

(*Marquis of Salisbury.*) I, myself, have been a large carrier of manure by railway, for my own purposes, and I think that the charge to me was 3*s.* 6*d.* a ton to Hatfield.

4528. What would the charge be upon the navigation for hauling?—That is a question which the traders must look to.

4529. The railway company are haulers as well as owners of the rates, so that it is quite possible that practically they merge any rates in the charge which they make for the carriage?—Probably.

(*Mr. Glass.*) They charge about 2*s.* to 3*s.*, according to the distance. It is generally done by the freighter; he pays for the manure and all; a man goes to the yards in London and gets a barge load of manure.

4530. I presume that your navigation has a beneficial effect as regards the farmers in the neighbourhood?

(*Mr. Glass.*) There is no doubt of it.

4531. (*Professor Way.*) But it is possible that in spite of rates not being levied on manure, if carried by the navigation, the cost might be quite as much or more than the carriage by railway?

(*Mr. Glass.*) It depends upon the barge owners.

4532. (*Professor Way.*) That does not give us any notion how cheaply the manure can be carried?

(*Marquis of Salisbury.*) I think that it is 14*d.* a ton to Hertford, that is the price of the manure altogether.

4533. The rates must be a small proportion of the carriage?—Yes.

(*Mr. Glass.*) It is about 6*d.* a ton?

(*Marquis of Salisbury.*) I used to import manure down to Hertford at 14*d.* for 40 tons, the parties furnishing me with the manure.

4534. (*Chairman.*) I presume that the trustees have had decisions as to parties polluting the water of the navigation?—To a very small extent.

4535. Do you consider that you have sufficient power to deal with the parties causing those pollutions?—I think not.

4536. Do you think that it would be advisable that some additional power should be provided to prevent this state of pollution which is growing up?—I think it very desirable indeed. The cases are rather frightful cases; there is, I think, one case of a man going up to Limehouse Cut, and dying of cholera within 48 hours; he was a bargeman from this part of the country; but there is an universal complaint of it.

4537. Have you arrangements with the two great East of London water companies, namely, the New River Company and the East London Company, for supplying water under certain conditions?—Yes, under an Act of Parliament of 1855.

4538. And you receive a certain rental from them?—We do.

4539. Do you consider that as trustees you have a moral obligation placed upon you to preserve the water pure for the use of the metropolis?—We certainly should think so; we should think it very desirable to do so.

4540. And I presume that you now, as far as your means will carry you, do what you can to prevent the pollution?—We do what we can to the full extent that we think that we have the power, or should be justified in applying the funds.

4541. But you know of your own knowledge, and also by hearsay, that impurities find their way into the river Lee, which forms a source of supply to the eastern portion of the metropolis?—Certainly.

4542. And I daresay that you have heard this autumn that cholera has prevailed very extensively in that eastern portion of London?—I have.

4543. Have you noticed that the Registrar General, whether rightly or wrongly, attributes the outbreak of cholera in some measure to the impure character of the water distributed by the East London Waterworks Company?—I have seen such a report.

4544. I presume that you are aware that that water does receive the sewage of a considerable population situate above the point at which they abstract it?—Certainly.

4545. The town of Luton is, I believe, situate near the head of the main river Lee?—The Lee rises immediately above Luton.

4546. And a large manufacturing population at Luton passes its sewage into the waters of the Lee?—I am not quite aware of what has taken place lately, but Mr. Leigh, when he bought Luton Park, made some arrangement with the town of Luton; there was a lawsuit about it, and the water is supposed to be diverted in his park.

4547. The water at Luton is dealt with in somewhat a similar manner to the mode in which it is dealt with here, the sewage is passed into depositing tanks, and the sediment is intercepted, and the effluent water passes into the Lee and goes on. Any person who calls that a purification of sewage does not understand the chemical character of the water, because it comes in to the tank true sewage, full of a solid deposit, and it simply passes out true sewage freed from the solid deposit?—I am aware that that is the fact. I was not aware what the arrangement was.

4548. We may take it all the way down. We have yet had no evidence that there is any true utilization of sewage by applying it in irrigation to land?—No; I should think that the valley is never wide enough to allow of such utilization, even if it is good.

4549. Would the application of pumping enable

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you to put it in another position than that in which it would go by gravity?—I should think it very difficult, the banks are rather steep.

4550. Looking at the constitution of the River Lee Trust, is it the opinion of yourself as chairman that the trustees would take upon themselves the necessary duties, if Parliament granted them the power, to prevent these pollutions through their servants?—Do you mean from Luton?

4551. Taking the whole valley of the Lee, supposing a conservancy board to be formed, would the trustees be willing that they should be constituted a conservancy board, having proper powers and proper authorities to prevent in a practical way these nuisances which now pollute the Lee and its tributaries?—My own opinion is that they would, but they must have means to do it beyond their navigation.

4552. You have now the means of arranging with the two great water companies to receive a rental for the water which they take from you, and to carry out works by arrangement and agreement with them, they paying the costs?—Yes.

4553. Assuming that Parliament thought fit to devise some machinery by which you should be required to give notices to these towns which now pollute the streams, calling upon them to show you through their engineers the way to prevent that pollution, and either to compel them to carry out the work under your supervision, or to enable you to carry it out, and to charge them with the cost, do you think that such a form of conservancy could be made to work?—I think that it could perfectly, and the more so because the members for Hertfordshire, and Essex and Middlesex, and the members for this town, and the mayor of this town, all form a part of the board *ex officio*.

4554. Do you think that the present constitution of the board is such as would justify Parliament in placing such powers as are indicated in their hands?—I think so.

4555. What is the gross number of the trust at present?—67, that is including the *ex officio* members.

4556. What is the mode of election?—The greater portion of the members are *ex officio*.

4557. By reason of their position and holding property?—Yes; and the remainder are elected by our own board, notice being given that such a person will be proposed.

4558. Is there any check upon the acts of the trustees. Supposing that any trader upon the river Lee feels himself aggrieved, is there any superior board of appeal to which he can go for redress?—I think not; we generally have some of the principal traders upon the board.

4559. But is there any board of appeal if any person wishes to appeal?—I am not aware that there is any.

4560. In the event of a conservancy being established do you think that it would be advisable that any board of appeal should exist, such as the Board of Trade, or the Privy Council, or the Home Office?—I apprehend that there could be no objection to it whatever, but if I were to name the board I should say the Board of Trade or the Privy Council.

4561. If Parliament were to authorize powers of conservancy similar to those now exercised by the conservancy board of the river Thames, do you think that it would be advisable that the Government should have the power to nominate one or more members upon the trust as they have to nominate such members upon the conservancy board of the Thames?—I do not think that it would be desirable, because such a member must naturally be immediately the head person of the trust, and give his constant attention to it.

4562. The Government, I think, have power to nominate one or two members upon the conservancy board to act as the other members act?—I do not think that it would answer well. I would give every facility of appeal, but I think that what you suggest would impede the action, because it would be exactly as it is in London, namely, that wherever you have a stipendiary magistrate he takes the thing into his own hands.

4563. I do not anticipate anything of that sort; you would appoint your own engineer and your own clerk, just as you appoint your servants now, and would have power to pay them?—I do not think that the suggestion would answer.

4564. (*Professor Way.*) A member of the Admiralty board has been on the board for years?—He very seldom attends the meeting.

4565. (*Chairman.*) In the case of the Thames such a member attends, the Admiralty being supposed to have a direct interest, but the Admiralty has no direct interest in your navigation?—No; I do not think that is a very desirable thing.

4566. (*Professor Way.*) I presume that the object would be that in case of any point arising in which Government interference would be requisite some member of the board should be in communicafion with the officers of the Government; you know that at present the new conservancy of the Thames has that element?—I was not aware of that fact; I myself do not think that it would be a desirable mode, because it would be a party matter. Where I have known it to exist it does not seem to me to work satisactforily; it ends in an absence from interference on the part of the other members.

4567. (*Chairman.*) Your lordship is aware that the Local Government Act has been adopted by many of the towns and parishes, and townships upon the banks of the Lee and its tributaries?—I believe that it has.

4568. When the Local Government Act is put in force I suppose your lordship is aware that it sets up a local authority, and that there must be a chairman and members?—Yes.

4569. As they for the most part are the sources of pollution they would be the parties with whom you would have to interfere to prevent pollution. Do you think that it would be advisable that the chairman of those local boards should sit at the conservancy board?—Certainly not.

4570. They are the persons whom you have to keep in order, and they are not to keep you in order?—Just so.

4571. (*Mr. Harrison.*) Would you exclude the mayor of Hertford?—Certainly not; he is an *ex officio* member.

4572. But, I suppose, that he is at the head of the polluting system?—He has the advantage of being approved by a magistrate. I have had put into my hand a letter which shows how little the local boards are inclined to act. This is an answer to our application to the Ware local board on account of the nuisance created by the Ware sewage: "Dear sir,—I "submitted your letter of the 27th instant to the "board at their last meeting, relative to the drains "discharging into the river Lee near the summer-"houses at Ware, and also below Ware bridge, and I "am directed to inform you that the board see no "reason for taking any measures for the diversion "of any drains belonging to them."

4573. (*Chairman.*) With regard to the conservancy which we have been speaking about, in your opinion would this Commission be justified in making a recommendation that the trustees should be consulted by Her Majesty's Government as to the future management of the Lee, going no further than that?—Certainly; I should think it very desirable.

4574. It has not been settled yet which department of the Government shall undertake the duty of bringing in a bill, but when a bill is brought in you think that they should communicate with your lordship and the trustees as to the form which the future conservancy should take?—I think that it would be very desirable, and I am sure that the trustees would give their best attention to it.

4575. May we assume that the trustees would rather not have an entirely new board placed above them, and having jurisdiction over the valley and over the river Lee navigation?—I am quite certain that it could not

be done, and that there would altogether cease to be an attendance.

4576. If any new conservancy board were set up there would have to be paid officers, and they would, in some degree, come into antagonism with you as managers of the river Lee for navigable purposes, but having interests also in keeping the river free from impurities?—Yes.

4577. (*Professor Way.*) I suppose that we may take it to a certain extent, that you would have less difficulty in so modifying, if necessary, your trust as to make a conservancy board than the conservancy of the Thames had, seeing that in that case there were two jurisdictions, one of which had to be abolished?—Certainly.

4578. You have nothing of the kind, you stand without any sort of supervising jurisdiction?—Entirely so.

4579. (*Mr. Harrison.*) Is it quite so; have not the New River Company and the East London Waterworks Company such an interest in the water of the river Lee and in its condition, as to purity, that they would like to be represented upon your board?—By our constitution the governor and deputy-governor of the New River Company are *ex officio* members of the trust.

4580. Is there any representation of the East London Waterworks Company upon your board?—I think not.

4581. Do you think that that would be desirable?—I think that it would be introducing a new element. We have never found that the New River Company have interfered to make the water more pure, and there would be an antagonistic principle introduced between the East London Waterworks Company and the New River Company. The New River Company have never interfered except as to the formation of a storing reservoir; they have never attended a board meeting except during that negotiation.

4582. (*Chairman.*) I suppose that this Commission may understand that the River Lee Trust would decidedly object to any interference with their existing powers in the way of diminishing or crippling those powers, but that they would be willing to be consulted as to any addition to their powers for the prevention of the nuisances which have grown up in the district?—I believe that that is quite correct.

4583. Has there been any system of drainage carried out in the valley with which your lordship is acquainted?—In my own parish, in my own park.

4584. Is there much undrained land on the margin of the Lee as far as you are acquainted with it?—I should think that all the marshes are very low, and in many portions the river is above the marshes.

4585. What is the character of the works which have been carried out in your own park?—They are very rough.

4586. Is the result beneficial?—It has completely stopped the arrival of the sewage into the river. Here is a rough plan (*producing the same*). I began the work in the first instance by sinking wells at different places, but I found that my wells answered the purpose for only two or three years. About 15 years ago I made this work (*pointing to the plan*). These are the holes which I made in the valley to intercept the sewage from the river. I have a statement of the expense, and I have the quantity of sewage; about one-third of that is earth. I have the quantity which we have got out for 1863, 1864, and 1865.

4587. (*Mr. Harrison.*) Is this for the interception of the sewage from your mansion?—It is for the sewage from the town of Hatfield. The first attempt was merely to turn it into a chalk pit, and get rid of it.

4588. (*Professor Way.*) That was happily unsuccessful?—I had reason to be satisfied with it, except that I had to sink a fresh chalk-pit every two or three years, and then I adopted this plan, which does the work perfectly in that way till it gets charged; but it is a work of several years. The solid part of the sewage is stopped by gratings, and by a man who is kept to throw it up and cover it over with mould. The liquid part goes into this chalk pit by having two holes acting as a syphon; the sewage goes down into the chalk with the water, and of course the water rises up on the other side, so that no effluvium can escape so long as the thing works.

4589. (*Chairman.*) Has your lordship's attention been at all directed to the question of utilizing the flood waters of the valley of the Lee, so as to make them available for metropolitan water supply?—There is no difficulty at all about it. An excellent plan was introduced, and it was brought into Parliament, and no doubt would have been carried into effect, but there was a gentleman then at the head of the river Lee board who was frightened at the expense. I will read the notice which was given of that bill in 1850 for the session of 1851.

4590. Was that a notice given by the River Lee Trust?—No, by the New River Company; we were parties who were agreeing with them.

4591. You sanctioned it?—Yes, we were ostensibly the promoters.

His lordship read the notice, as follows:

River Lee Trust.

Amendment of Acts; Extension of Powers; Enlargement of existing Works; and Construction of new Works.

Notice is hereby given, that application is intended to be made to Parliament in the ensuing session for leave to bring in a bill to enable "the trustees of the river Lee" to effect all or any of the objects hereinafter mentioned, (that is to say) to make, maintain, vary, extend, or enlarge the following works, viz., first, a reservoir on the river Lee, commencing in Hatfield Park at or near Cecil Hill in the parish of Bishop's Hatfield, and terminating by an embankment to be constructed across the valley of the Lee, near Roxford farmhouse, in the parish of Bayford, and which reservoir and embankment will be situate in the parishes, townships, or extra-parochial places of Bishop's Hatfield, Essendon, Bayford, Hertingfordbury, and Brickendon, some or one of them; second, a reservoir adjoining the river Lee, commencing and terminating at or near Ware Mill lock in the parishes, townships, or extra-parochial places of St. John's, Hertford, Ware, Little Amwell, and Great Amwell, some or one of them; third, a reservoir on the river Rib, commencing near Stondon Lordship House, otherwise Standon Lordship House, in the parish of Stondon, otherwise Standon, and terminating by an embankment to be constructed across the valley of the Rib at or near Swangles, in the parish of Thundridge, which embankment and reservoir will be situate in the parishes, townships, or extra-parochial places of Stondon, otherwise Standon, Thundridge, Ware, and Ware-side, some or one of them; fourth, a reservoir on the river Ash, commencing at or near Widford Mill in the parishes of Widford and Ware, or one of them, and terminating by an embankment across the valley of the Ash, at or near Easney Park Wood in the parishes, townships, or extra-parochial places of Widford, Ware-side, Ware, and Stanstead Abbott's, some or one of them; fifth, a tunnel, pipe-track, aqueduct, cut, or channel of communication, from the first-named reservoir near Roxford farmhouse, to the secondly above-named reservoir near the Ware Mill lock, and which said tunnel, pipe-track, aqueduct cut, or channel of communication will pass in, through, or into the parishes, townships, or extra-parochial places of Bayford, Hertingfordbury, Brickendon, Saint Andrew's, Hertford, All Saints, Hertford, St. John's Hertford, Ware, Little Amwell, and Great Amwell, some or one of them; sixth, a tunnel and conduit, cut, or channel of communication from the thirdly above-named reservoir, commencing at or near Timber Hall in the parish of Thundridge, and terminating at the fourthly above-named reservoir, near Hole farm, in the parish of Ware, and which last-mentioned tunnel, conduit, cut, or channel of communication will pass in, through, or into the parishes, townships, or extra-parochial places of Thundridge and Ware, or one of them; seventh, a tunnel, pipe-track, aqueduct, cut, or channel of communication from the fourthly above-named reservoir, at or near Easney Park Wood, to extend across the valley of the river Lee, and terminating in the bed of the New River, near the village of Amwell; and which said last-named tunnel, pipe-track, aqueduct, cut, or channel of communication will pass in, through, or into the parishes, townships, or extra-parochial places of Ware, Stanstead

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Abbott's, Great Amwell, and St. Margaret's, some or one of them; together with all other necessary cuts, sluices, pipe-tracks, channels of communication, aqueducts, embankments, tunnels, and other works for connecting the said reservoirs, tunnels, cuts, channels, and aqueducts with the river Lee and New River, both or either of them; all which said reservoirs, cuts, pipe-tracks, channels, aqueducts, embankments, tunnels, and works, will be made and maintained, and pass from, in, through, or into the several parishes, townships, or extra-parochial places of Bishop's Hatfield, Essendon, Bayford, Hertingfordbury, Brickendon, St. Andrew's, Hertford, All Saints, Hertford, St. John's, Hertford, Little Amwell, Stondon, otherwise Standon, Thundridge, Ware, Widford, Ware-side, Stanstead Abbott's, St. Margaret's, Little Amwell, and Great Amwell, some or one of them. Also to make and maintain all proper and necessary balance engines, gauges, tumbling bays, and other devices and works, on and near the New River and river Lee, at and below Fielde's weir, for correctly ascertaining the flow of water, and to remove all existing balance engines, gauges, tumbling bays, and other devices and works.

And it is also intended by the said bill to take powers to alter and improve certain parts of the course of the New River, and for that purpose to make and maintain the several works herein-after mentioned in the lines and according to the levels defined upon the plans and sections herein-after referred to, that is to say:—the first of such works, consisting of cuts or channels of communication, pipe-tracks, and widenings of the said New River, and commencing at a point about 214 yards above the bridge over the New River (numbered 4) in the parish of St. John, Hertford, and terminating at the bridge over the New River in Theobald's Lane in the parish of Cheshunt. The second of such works, consisting of cuts or channels of communication, pipe-tracks, tunnel, and widenings of the said New River, and commencing at a point about 290 yards above the foot-bridge over the New River in Theobald's Park (numbered 51*a*) in the parish of Cheshunt, and terminating at the north-east end of the reservoirs of the governor and company of the New River brought from Shadwell and Amwell to London in the parish of Stoke Newington, otherwise Newnton; with a branch pipe-track, conduit, or channel of communication, commencing at a point above 213 yards above the bridge over the said New River (numbered 82) and terminating at a point about 100 yards below the bridge over the said New River (numbered 105) in the parish of Edmonton; and also with a branch pipe-track, cut, conduit, or channel of communication commencing at a point about 30 yards above the bridge in the Seven Sister's Road over the New River, and terminating at the eastern end of the Stoke Newington reservoir of the said governor and company in the parish of Stoke Newington, otherwise Newnton. The third of such works, consisting of cuts or channels of communication, pipe-tracks, and widenings of the river, and commencing at the south-west end of the reservoirs of the said governor and company in the parish of Stoke Newington, otherwise Newnton, and terminating at the aqueduct of the said river over the East and West India Docks and Birmingham Junction Railway in the parish of Saint Mary, Islington. Fourth, a reservoir on the New River commencing at or near Clay Hill farmhouse in the parish of Tottenham, and terminating near to the bridge over the said New River in White Hart Lane in the said parish of Tottenham. Fifth, a reservoir on the New River commencing at the bridge in the Green Lane on the New River, near to the Stoke Newington reservoirs of the said governor and company and terminating at or near to the Eel Pie House Tavern, Highbury Vale, in the parish of Hornsey. All which works will be made in or pass through, from, or into, the parishes, townships, or extra-parochial places following, or some of them (that is to say), St. John's, Hertford, Little Amwell, Great Amwell, St. Margaret's, Hoddesdon, Broxbourne, Wormley, Cheshunt, Enfield, Edmonton, Tottenham, Hornsey, Stoke Newington, otherwise Newnton, and St. Mary's, Islington; and also to make and maintain all necessary tunnels, pipe-tracks, sluices, embankments, aqueducts, cuts, or channels of communication for the convenient use and maintenance of such several works, and to remove all such existing works as may interfere therewith; and also for the purpose of improving the drainage, to alter and shorten the course of a certain common sewer on Chase-side in the parish of Enfield, in the manner and direction shown upon the plans herein-after referred to, such alteration being intended to commence at a point in the highway from Chase-side to Enfield Church, near the bridge over the New River (marked No. 69), and to terminate by a junction with the common sewer in Enfield Street where such sewer crosses the highway aforesaid. The whole of such alteration being in the said parish of Enfield.

And it is also intended to apply for powers more effectually to prevent the contamination of the river Lee and New River, or either of them, or any stream, reservoir, aqueduct, or other works connected therewith respectively.

Also to form a roadway, with all necessary bridges, approaches, and works from the bridge across the navigable cut of the river Lee, near the Hertford gas-works, to the public road leading from Bengeo to Ware Park, and which roadway will pass through or into the parishes, townships, or extra-parochial places of St. John's, Hertford, and Bengeo, or one of them.

Also to vary, divert, or stop up and relinquish the Ordnance corn millstream, otherwise Waltham Abbey millstream, and the tail and waste channels leading therefrom, by constructing an embankment across the said corn millstream, at or near the point where it diverges from the old river Lee at Edmondsey Meads in the parish of Waltham Holy Cross. Also to vary, divert, or stop up, and relinquish that branch from the river Lee forming Stewartstone Mill Head and the tail waters and waste channels leading therefrom (which last-mentioned branch diverges from the main channel of the river Lee at or near the sluice at Enfield Lock in the parish of Enfield) and that branch from the river Lee and tail waters and waste channels leading therefrom forming Chingford Mill head and tail (part of which said branch diverges from the river Lee at or near Ponder's End Lock), and also forming that branch of the river Lee called Walthamstow Copper Mill head and tail, and the waste channels leading therefrom, all which streams now terminate in the river Lee at the Copper Mill stream near High Bridge in the parish of Walthamstow, and run from, in, through, or into the parishes, townships, or extra-parochial places of Cheshunt, Waltham, Waltham Holy Cross, Sewardstone, Enfield, Edmonton, Chingford, Walthamstow, and Tottenham, or some or one of them; and also to form a tumbling-bay and cut from the river Lee immediately above the Stone Bridge lock to a point in the same river immediately below such lock, and to make and maintain all such embankments, sluices, and other works as may be necessary for varying, diverting, or stopping up the said streams, channels, and tumbling-bay; and also to construct all such new works as may be necessary for the convenient use and maintenance of such new reservoirs, cuts, aqueducts, and tunnels, and such diverted or improved streams, channels, tumbling bays, and other works, and to remove all such existing works as may interfere therewith; and also to abandon and discontinue using, as the channels of such streams and branches, any portions of the existing courses or lines of the river Lee which may be rendered unnecessary by reason of the execution of the proposed new reservoirs, cuts, channels, or works, and generally to take powers to construct all such new works and remove all such existing works or other obstructions as may be necessary for effecting the objects of the proposed bill. And it is also intended by the said bill to take powers to divert into or cause to flow or proceed through or into the proposed works the waters which flow in or supply the streams, cuts, canals, reservoirs, aqueducts, or navigations herein-after mentioned, that is to say, the river Lee and the several streams, cuts, canals, reservoirs, aqueducts, and navigations connected therewith, videlicet:—The Hertford cut, Parker's cut, Hadsley's cut, Stanstead cut, the cut next below Stanstead bridge, Fielde's Weir cut, Dobb's Weir cut, Hoddesdon or Lins mill-tail, Broxbourne mill-head and tail, Carthagena cut, Waltham cut, Cheshunt mill stream, Powder mill stream, Waltham Abbey mill stream, Waltham Common Cut, Enfield Cut, Enfield Mill Stream, Edmonton Cut, Chingford mill stream, Tottenham Mill Stream, and Tottenham New Cut, Walthamstow Mill Stream, the Hackney Cut, Temple Mill Stream, Abbey Mill Stream, West Ham Waterworks Stream, City Mill Stream, Stratford Mill Streams, Pudding Mill Stream, otherwise Hunter's Mill Stream, the Three Mills Stream, the Bow Creek and the Limehouse Cut, the river Mimram, and the several streams, cuts, canals, reservoirs, and aqueducts connected therewith; the river Beane and the several streams, cuts, canals, reservoirs, and aqueducts connected therewith; the river Rib and the several streams, cuts, canals

reservoirs and aqueducts connected therewith; the New River and the several streams, cuts, canals, reservoirs, and aqueducts connected therewith; the river Ash and the several streams, cuts, canals, reservoirs, and aqueducts connected therewith; the East London Waterworks Company's cuts, canals, reservoirs and aqueducts; Sir George Duckett's Canal, otherwise the Lee Union Canal, and the streams, cuts, canals, reservoirs, aqueducts and navigations connected therewith; the Regent's Canal and the several streams, cuts, canals, reservoirs, aqueducts, and navigations connected therewith and the river Thames.

And it is also intended by the said bill to take powers to make and maintain a sewer or drain, or sewers or drains, and culverts, sluices, and other works connected therewith, for intercepting and diverting the sewage of all sewers and drains from emptying into the rivers Lee, Beane, Mimram, Rib, Ash, and Stort, or any of them, which sewer or drain, or sewers or drains, will commence on the north side of Cowbridge in the parish of St. Andrew, Hertford, and will be made and maintained, or will pass from, in, through, or into the parishes, townships, or extra-parochial places following or some of them (that is to say), St. Andrew's, Hertford, All Saints, Hertford, St. John's, Hertford, Little Amwell, Ware, and Great Amwell, some or one of them, and will terminate at or near Amwell Marsh bridge in the parish of Great Amwell. And also to take power to prohibit and prevent any drain or sewer from flowing into the river Beane below Sele Mill in the parish of St. Andrew, Hertford, or into the river Lee between the Horns Mill in the liberty of Brickendon, andAmwell Marsh lock, or into any part of the New River; all which parishes, townships, or extra-parochial places herein-before mentioned are situate within the counties of Hertford, Essex, or Middlesex, some or one of them.

And it is also intended by the saidbillto take powers to make lateral deviations from the lines of the said intended works to the extent and within the limits defined on the plans to be deposited as herein-after mentioned, and to purchase, lease, and otherwise acquire, compulsorily or by agreement, lands, houses, mills, and other hereditaments, corporeal or incorporeal, and to stop up, alter, or divert roads, railways, rivers, canals, cuts, aqueducts, tunnels, drains, sewers, reservoirs, and streams for the purposes of the said bill, and to extinguish any existing rights and privileges, which may interfere therewith; to provide compensation to the owners and tenants of mills in such manner as may be deemed expedient, and also to take power to raise money for carrying out the objects and provisions of the said bill; to levy tolls, rates, duties, and water rents for or in respect of the several purposes of the said bill; to alter existing tolls, rates, duties, and water rents, and to confer, vary, or extinguish, exemptions from tolls, rates, duties, and water rents; and also to authorize the trustees to appoint committees of their number with such powers as may be deemed expedient, and to confer, vary, or extinguish all such powers, rights, and privileges, as may be necessary for carrying into execution the purposes and provisions of the existing Acts hereinafter mentioned and of the said bill.

And notice is also hereby given that duplicate plans and sections, describing the lines or situations and levels of the several intended works before mentioned, and the lands in or through which the same are to be made, maintained, varied, extended, or enlarged, together with a book of reference to such plans, containing the names of the owners or reputed owners, lessees or reputed lessees and occupiers, of all lands and houses in the line of the proposed works or within the limits of deviation as defined upon the said plans, and describing such lands and houses respectively, with a copy of this notice, as published in the "London Gazette," will, on or before the 30th day of November 1850, be deposited at each of the following places, that is to say, with the clerk of the peace for the county of Hertford at his office at St. Albans; with the clerk of the peace for the county of Essex at his office at Chelmsford; and with the clerk of the peace for the county of Middlesex at his office in Clerkenwell Sessions House; and a copy of so much of the plans, sections, and book of reference as relates to each of the several parishes before mentioned, with a copy of this notice, will, on or before the said 30th day of November, be deposited with the parish clerk of each such parish at his place of abode, or, in the case of any extra-parochial place, with the parish clerk of some parish immediately adjoining thereto at his place of abode.

And notice is further given, that it is intended by the said bill to alter or amend, or in whole or in part to repeal, the following Acts, and any Acts therein-mentioned or referred to (that is to say), 13th Elizabeth, chapter 18; 3rd James I., chapter 18; 4th James I., chapter 12; 11th George II., chapter 14; 12th George II., chapter 32; 7th George III., chapter 51; 19th George III., chapter 58; and the Local and Personal Acts, 45th George III., chapter 69; 47th George III., chapter 72; 48th George III., chapter 8; 3rd George IV., chapter 109; 10th George IV., chapter 117; and 13th and 14th Victoria, chapter 109.

Dated this 11th day of November 1850.

JOHN MARCHANT,
Clerk to the Trustees, Ware.

In short, any attempt to divert the sewage without some reservoirs would be almost impossible, because with every diversion of the sewage you would lose a great quantity of water, which must be supplied in some way or other.

4591*a*. Then I may assume that you think that it would be necessary that any legislative powers should arm the trustees with authority to look at all points, and should enable them to devise and carry out the prevention, or assist in preventing the pollution of the river, and in providing for the increased volume of pure water which may be passed on to the metropolis?—I think so; but that I think would be a matter for a special Act of Parliament.

4592. I assume that you have heard that it has been proposed to bring in increased supplies of water to the metropolis, from North Wales by one scheme, and from Cumberland and Westmoreland by another scheme?—I have.

4593. If the river Lee itself and the waters falling into the valley of the Lea were properly dealt with, do you think that such a scheme might be more economical than going to such a distance for water for the metropolis?—530,000*l*. was the estimate given in the case of the bill of which I have read the notice, dated in 1850.

4594. (*Professor Way.*) That was for increasing the available supply of water, and for improving its quality?—Yes.

4595. (*Chairman, to Mr. Beardmore.*) I assume that an estimate was made of the probable income which would be yielded from the works so as to cover the expenditure?—(*Mr. Beardmore.*) I do not know whether that was gone into, because the companies dropped the scheme at an early date. We did not go into evidence before Parliament upon it. With the prospect of a very largely increased supply of water we no doubt reckoned on a large increase of revenue from the water.

4596. (*Mr. Harrison.*) Were the embankments which you proposed to make so as to form these reservoirs to be constructed in any case upon the chalk formation?—(*Marquis of Salisbury.*) I think that in most of these streams the embankments are already made by the millowners, and that they would only require a little raising.

4597. (*Professor Way.*) This proposal was made in 1850?—Yes.

4598. Has anything which you know of occurred in the interval which would cause a serious alteration in this plan, supposing the powers existed to put it into operation?—I should think not.

4599. You think that the plan would be now available?—Yes; of course the expense of the land would be increased.

(*Mr. Beardmore.*) The plan would have to be modified.

4600. That scheme was dropped from the want of means and power to carry it through?—(*Marquis of Salisbury.*) It was dropped, I think, from the want of means; there was no opposition to it.

4601. Supposing that your board of trustees were constituted a conservancy board, would the resuscitation of that plan in any form be possible and desirable?—I think that with certain modifications it would be very desirable. Of course I cannot speak to the details of a plan before Parliament.

4602. (*Chairman.*) I suppose that we may assume that the trust would watch very narrowly any scheme

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of that magnitude and character brought in by what one may term outside persons?—Certainly.

4603. If such a scheme were brought in by any speculators wishing to utilize, as they would term it, the waste waters of the Lee for commercial purposes you would look very earnestly at it before you permitted them to obtain parliamentary powers, if you could prevent their doing so?—I should decidedly think so.

4604. (*Mr. Harrison.*) There was one point which I think your lordship raised just now, and did not give a full explanation of; it was as to the funds which the trustees of the Lee would require in case they were formed into a conservancy board such as you recommend. You said that the funds would be a difficulty. Where do you think that the requisite funds could be obtained from?—I think that the requisite funds might be readily obtained by imposing full costs and penalties wherever a nuisance was supposed to exist.

4605. Do you expect that they would be sufficient to pay for the supervison of the valley of the Lee?—As a board of conservancy has been proposed, it would only require the supervision of the channel of the Lee which we at present perform, but I apprehend that we could not embark in litigation with boards. If we required expensive alterations we should be opposed by local authorities unless we did it at our own cost.

4606. You would require a summary means of punishing those who committed a nuisance, so as not to entail much expense?—Yes; the cost of the litigation with the metropolitan board was upwards of 1,000*l.*; our funds will not allow us to carry on proceedings of that kind.

4607. (*Chairman.*) As a board having public duties, and having no pocket interest in exercising those public duties, supposing that you were placed in a position where it was necessary to raise additional funds to carry out works of great public utility, do you think that you would be in a condition to ask the Government of the day to allow the Chancellor of the Exchequer to issue exchequer bonds at a low rate of interest, you giving the security of the navigation so as to get the money at a less rate of interest than you could get it at in the commercial market?—I rather think that there is always a condition of repayment in the advance of exchequer bonds, and generally I believe it is in 30 years; there would then be the necessity of a sinking fund, which would add very materially to our expense.

4608. If you want anything like half a million the Exchequer Loan Commissioners, without any injury to any person in the State, can lend that money in the present condition of the money market at 3½ per cent.?—Just so.

4609. If you repaid that money in 30 years the annual payment would be about 5*l.* 5*s.* per cent.?—Just so.

4610. I believe that for certain public purposes, and also for private purposes, the Exchequer Loan Commissioners have been authorized by Parliament from time to time to make loans, for instance, for land draining?—Yes.

4611. For carrying on public works in Ireland?—Yes.

4612. And recently for carrying on certain public works in Lancashire, for the relief of the distressed cotton labourers?—I am aware of that.

4613. That money being repayable by annual instalments with interest?—Yes.

4614. It has been considered a very great advantage in many of these places (in Lancashire, for instance, where works have been carried out) for the local authorities to get that money at 3½ per cent., and yet Government will not necessarily lose one farthing in the transaction?—Just so; but I am not quite sure that it would not entail a loss upon the parties who would be supposed to profit by it, because the whole of the country said to be benefited by it would not have anything to do with the supposed relief.

4615. Looking at it in that view you think it better to go on as you have done and to raise any money required in the open market upon such terms as you can raise it?—I think so, and I think that it would rather tend to more economy in the management.

4616. If you have power to borrow and to reborrow it always gives you the power of rectifying your loan by the existing state of the money market?—Exactly so.

4617. If you pay off a debt which you owe to a party, which debt is at 4½ per cent., and you can borrow money at 3½ per cent, you can as a trust relieve yourselves to that extent?—Yes, and we should feel bound to do so; it would be a financial operation, whether it was wise or not wise.

4618. You do not borrow in perpetuity, but you borrow for a limited term?—Yes.

4619. Having the power of repaying the money, or of borrowing to pay off the bonds which you have accepted up to that time?—Yes.

4620. You, I suppose, accept bonds for three, five, seven, and 21 years?—We have never gone beyond seven years.

4621. But those bonds are, I presume, renewable if agreeable to yourselves and to the parties?—If they are allowed to run on beyond the period we put a condition that the debentures shall be realisable at six months' notice.

4622. Are those debentures easily transferable?—Very much so.

4623. Are they taken by trustees?—(*Mr. Marchant.*) They are made available for trustees.

4624. And they can recover their money at short notice?—(*Marquis of Salisbury.*) Yes, in three, five or seven years, and afterwards at six months notice just like the case of any other mortgage.

4625. That makes it an available means of investing money, and one which many persons are very glad to have an opportunity of availing themselves of?—Just so.

4626. And you consider that you have a secure basis for paying the interest?—I can only say that I think so, for I am a very considerable debenture holder, but of course it is a matter of opinion. We have been in great difficulties during the last year and a half; we have had very heavy works to carry on and have had very great difficulty as regards the money, but our bankers have not hesitated to advance us money.

4627. (*Professor Way.*) We have been informed that you have a surplus of profits at this moment?—Yes.

4628. Supposing that you borrowed money from the Government funds at a less interest and paid off the old debt, would not that surplus be available for the gradual liquidation of the debt?—I think not for many years, because we have still considerable improvements to make.

4629. But you would have the means of borrowing a much larger sum at a lower interest?—We might have, but I am not quite sure that we should judge wisely in going too largely into things at once. We should get into a great system of contracts. I certainly should not recommend it; I would rather go on quietly. We are now in very good condition except with reference to two or three locks, and the sills of those locks must be lowered to enable us to make the navigation throughout navigable for boats of 120 tons, which is supposed to be our limit. It was only available for 40 tons. We carried a little more than we were authorized to do, and we now carry commonly 80 or 90 tons.

4630. You are not in the same position as the Commissioners of the Thames, who, besides a large debt, required a large outlay of money to put the river into a proper state?—No. I daresay that we shall spend all the money which we have power to raise in necessary improvements.

4631. (*Mr. Harrison.*) Is there a large area of land in the valley of the Lee liable to be flooded?—I think

that a large area of land in the valley of the Lee from Luton to Hertford may be flooded; Hertford is below Luton. From Rye House downwards there is a large tract of land which might be flooded; the valley widens out.

4632. The trustees have made certain cuts, so that in portions of the valley the navigation is in the channel of the river Lee, and in other parts there are new cuts? —Yes.

4633. Have the trustees any control over the river proper, along which the navigation does not pass?—I claim it under grant from the Crown in the old river.

4634. Then the trustees at present have no power over it?—They have abandoned the navigation. It has never come into question except as a fishing right. I pay a fee farm rent to the Crown.

4635. Do you think that it is desirable that the powers of the river Lee trustees should extend to those portions of the river as well as to the navigable parts of it?—No, I do not see that any object would be gained by it; it is not a matter of very great importance.

4636. Do you not think that if the whole river were placed under their jurisdiction they might be a useful body to carry out works to prevent the flooding of the adjoining lands?—I hardly see how it would be possible, because by the alteration of their locks the river in many places is considerably above the level of the land.

(*Mr. Marchant.*) Each reach might be drained into the reach below. There is a fall of 100 feet between this town and London.

(*Marquis of Salisbury.*) That must be by the purchase of land.

4637. Do you think that the land which is liable to be flooded below Waltham Abbey would be increased in value if steps were taken to prevent that flooding? —If it were my own land I should prefer its remaining as it is. I should prefer pasture land. A great deal of it is Lammas land.

4638. Is not a great portion of it in a wretched state, in an agricultural point of view?—No, I think that they are all very valuable meadows.

4639. Might not they be made more valuable if they were properly drained?—That is a question which I must not venture to answer. I am the proprietor of some land in the parish of South Mimms where the Mimms' wash runs through; it is a celebrated place where water runs over two or three times in the course of a week and disappears into chalk-pits, and it makes the most valuable land on the farm.

4640. In the valley of the Stort, and in the valley of the Lee itself, in passing up and down the railway, I see large areas of land covered with rushes?—That may be. I do not deny it at all.

4641. Surely that land could be improved. Is it generally considered that the flooding is an improvement to the land?—We consider so, provided that the flood does not last too long.

4642. (*Professor Way.*) Your lordship would like the benefit of the water, but you would like to have it under control?—Quite so.

4643. It is a compulsory flooding at present?—Yes, but it seldom remains on for a month in the course of a year. I should imagine that 3*l.* an acre is a very common sum, and that is the best test of the value of land.

4644. I suppose that a proper treatment of the district would enable you to keep the floods out, and to use them where you wished to do so?—I do not at all mean to say that the land is not capable of great improvement, but there are a great many proprietors.

4645. (*Mr. Harrison.*) If it is capable of improvement, do you not think that any improvements which were made should be made as a whole throughout the entire length of the valley?—I should think it very desirable, but then you must obtain the consent of a vast number of owners, because the greater part of the meadows are let in small portions; some are what are called cow leases, and things of that kind. There is no reason why it should not be done, but it is a great undertaking.

4646. It is undoubtedly a great undertaking, but does not your lordship think that if a trust were appointed for the whole of the river Lee it should embrace the carrying out of the works for such an improvement?—I have not the least objection to it, but I think that Parliament would hardly trust any body of men with the power compulsorily to buy up all the cow leases.

4647. I did not intend that, the point I contemplated was to carry out drainage works for the improvement of those lands, so as to prevent the flooding and to drain the whole valley of the Lee?—I am not prepared to say that it would not be very advantageous so to do, but a general drainage is one of those things which we have tried for a good many years, and we have not succeeded yet.

4648. (*Chairman.*) Of course your lordship is aware that this Commission must report to Parliament, and that we must make recommendations?—Yes.

4649. As Chairman of the Commission I only wish to say that I assume that we shall not be considered as travelling out of our way, if we take upon ourselves to recommend that the river Lee trustees be consulted as to any form of legislation for the future management of the water of the river and its navigation, and the water supply to the metropolis, and the prevention of pollution?—Certainly. It cannot be doubted that we as trustees should be very glad that it should be so.

4650. I asked the question because you might have told me that as trustees you would not trouble yourselves with the pollutions beyond indicting the parties who committed them, and would not take upon yourselves the extra amount of duty, seeing that you were an unpaid Commission, and then we should have had to have looked about and to have made some other form of recommendation?—It is the interest of the whole of this part of the country that every possible improvement should be effected, and we as the representatives of the counties and the residents are the persons who would be most interested in carrying out such improvement.

4651. (*Professor Way.*) But your duties would then be much extended; they would not be for the river but for the whole valley?—Those are matters of detail. I do not think that there would be any difficulty in it.

4652. (*Chairman.*) I suppose that before your lordship expressed any further opinion upon this question, you would say, "Let me see what your report and what your recommendations are?"—Exactly so; but I do not think that there would be any difficulty whatever in obtaining the assistance of all my co-trustees.

4653. Is there anything further which your lordship has to offer to the Commission?—I do not know that there is anything.

His lordship withdrew.

Mr. Alfred H. Jarrett (Hertford) examined.

4654. (*Chairman.*) You are inspector of nuisances for the borough of Hertford?—Yes.

4655. How long have you been inspector?—Since the end of 1862.

4656. What are the principal nuisances which are found within the borough?—Nuisances such as are generally found in towns; nothing particular; foul closets and offensive fæcal matter.

4657. How many waterclosets are there in this borough?—I do not know.

4658. How many common privies are there?—I cannot give you that information.

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4659. Are there more common privies than closets?—I think not.

4660. Have you had complaints made to you as to the foul smells from the sewers?—Several during the last three years.

4661. Have you, yourself, observed any foul smells from those sewers?—I have.

4662. Have you had any complaint of foul smells from the outlet works?—None.

4663. Do you occasionally inspect the outlet works?—No.

4664. Have you ever found the water of the river Lee in a foul state at any period of the year?—I have not, only what is occasioned by the atmosphere and rains.

4665. By being muddy?—By being muddy.

4666. Have you anything to do with the water supply?—Yes, I am superintendent of the water.

4667. What volume of water per day is supplied to the borough?—About 150,000 to 160,000 gallons from the new works.

4668. And what from the other works?—We pump up about 51,840 gallons per day from the old works; that makes a total of 2,201,840 gallons.

4669. What is your population here?—6,769

4670. How many persons take water—We have at present about 500 tenants to the works.

4671. How many individuals will that represent, about 2,500?—I make it about 4,955; there are between 500 and 600 persons who steal the water, who do not pay anything for the water but take it from the public taps.

4672. (*Mr. Harrison.*) Are the taps open to any one to take the water from?—No; they are put in public places, and they are paid for by the owners of property adjacent to them, and no one else has a right to take the water.

4673. (*Chairman.*) If you have 4,900 people supplied by your works, have you any idea how much each individual takes per day?—I should say that each individual consumes from 13 to 15 gallons per day.

4674. If you take 4,900 as the number of persons supplied, and 201,840 gallons as the volume supplied, you are giving more than 40 gallons to each person?

(*The Mayor.*) But there is the watering of the roads.

4675. (*Chairman.*) That is a very small quantity.

(*Mr. Jarrett.*) That is the quantity which is pumped, there are 51,840 gallons which are pumped from the old works, and if the consumption is not equal to the supply, a great portion of it returns down the waste pipe.

4676. Then you go on pumping it to let it run away again, you do not mean to say that?—I do, with reference to the old works, but not with reference to the new. We have no control because the old works are by water power, and there are no great means for storing the quantity of water which we pump.

4677. Therefore you let the waterwheel play with the water, pumping it up and letting it go away again?—We have no storage.

4678. Do you know how many waterclosets you supply?—I do not.

4679. Do you know how many houses are drained in the town altogether?—No, I do not know at present, but I can furnish you with the information at a future period.

4680. (*Professor Way.*) You said that 500 houses were supplied with water, and you put down the inhabitants of those houses at 4,000 odd?—Yes.

4681. That would be an average of more than eight people to a house?—Yes.

4682. Do you think that as many as eight persons live in a house here?—Yes, taking in Christ's hospital; I should take the whole of that establishment to be 600; we supply them with water.

4683. What other large establishment have you?—None.

4684. Taking the 600 off, there are seven to a house?—I should think that it would average that.

4685. Then the people live very closely packed together here?—I should say so usually.

4686. (*Mr. Harrison.*) Do you supply any schools with water?—Only Christ's hospital and the grammar school.

4687. How many lads are there at each of those establishments?—They vary according to the period of the year.

4688. Take the average?—I could not give it to you.

4689. (*Professor Way.*) You said 600 just now for Christ's hospital?—I take the number to be that. I should say that the whole of the establishment of Christ's hospital is close upon 600 people.

4690. (*Mr. Harrison.*) Besides Christ's hospital, do you supply any other large establishment?—Yes, the grammar school.

4691. How many lads are there in that establishment?—I cannot answer that question; I should say between 40 and 50.

4692. Are there any other establishments of the same sort which you supply with water?—No.

4693. Do you supply the union?—No, the union is out of the borough.

4694. What is the character of the sewerage works which you have carried out?—Principally in drainage, for draining the houses.

4695. Connecting houses with the main sewers formed by the New River Company?—Yes.

4696. You have not made any new sewers?—We have not done so ourselves.

4697. (*Chairman.*) Have you any further evidence to give?—No.

The witness withdrew.

Mr. W. Wilds.

Mr. William Wilds (Hertford) examined.

4698. (*Chairman.*) You are surveyor to the corporation of Hertford?—I am.

4699. How long have you been their surveyor?—About 12 years.

4700. You are also surveyor to the paving and lighting commission?—I am.

4701. Is that distinct from the corporation?—Yes. A part of the members of the corporation are *ex officio* commissioners on the other board.

4702. What do your duties consist of?—I merely take my orders from the mayor, and am chiefly employed upon the buildings belonging to the corporation.

4703. What buildings belong to the corporation?—The Corn Exchange and some other trifling property, and the old waterworks and the new waterworks.

4704. Have you anything to do with the cleansing of the ashpits and middens?—No.

4705. Do you know what number of waterclosets there are in this borough?—No.

4706. Do you know what length of sewerage and drainage has been laid down?—No. The main sewer was laid by the New River Company under their Act, and they were empowered to intercept all old drains, and to cut them off from any connexion with the river.

4707. Do you, as surveyor, devise and execute any house drains?—I am sometimes employed in my private capacity, but not by the corporation.

4708. When any persons want to drain what do they do?—They give notice to the New River Company's agent; they are bound by the Act to give 24 hours notice.

4709. Then are they allowed to break down and to connect with the sewer?—Yes.

4710. Is there any person to see that they make a proper connexion?—Yes, the superintendent at the deodorizing works attends to that matter on the part of the New River Company.

4711. Do you look after the highways and streets?

—For the commissioners of paving I survey the foot pavements, but I have nothing to do with the roads.

4712. Who manages the roads?—The stone wardens.

4713. What salary have you?—25*l.* a year from the paving commissioners, and I have no standing salary from the corporation.

4714. How do the corporation pay you?—They pay me the usual fee as an architect and surveyor.

4715. You are an architect in private practice, but you act as their surveyor when they choose to employ you?—Exactly so.

4716. Do you know the outlet works?—I have never been down to them since they were established. I have certainly been on to the ground at the beds, but I never examined the outlet.

4717. (*Mr. Harrison.*) Have any sewers been constructed in Hertford under your directions?—Yes, but very few, and to a very small extent.

4718. Discharging into the main sewers constructed by the New River Company?—Yes.

4719. Have you ventilated those sewers?—Not at all.

4720. Do you know of any others which have been constructed by the parish authorities beyond your district?—Yes, I have known others constructed, but I never knew any instance where private or lateral drains have been ventilated in any way; they have generally been trapped so as to prevent any escape of the effluvia.

4721. So that the only outlet of the gases from the branch sewers, as well as from the main sewers, is through the gully holes of the main sewers?—Exactly so.

4722. (*Professor Way.*) Are we to understand that the New River Company have not only made a main sewer, but that they regulate the connexion of the district sewers of the town with their main sewer?—The only way in which they interfere is that they require 24 hours notice, and the superintendent generally attends about the time mentioned for connecting the private drain with the main sewer.

4723. After connection, do the drains of the town come under the jurisdiction of the corporation?—No; the street drains are under the management of the stone wardens or parish surveyors.

4724. They are not under the corporation?—No.

4725. After the drains are made and connected, do the New River Company exercise any jurisdiction?—Only with the main sewers, and not with the side drains.

4726. But they require notice of the making of the side drains?—Yes.

4727. And after that their power ceases?—Yes.

4728. (*Chairman.*) Have you anything further to add?—I do not know that I have, except that with regard to the main sewers several complaints were made, and about two years ago I was ordered to devise means of flushing them, which I did, and I reported to the corporation, but it was thought too expensive, and was not carried out.

4729. And therefore they endure the nuisance instead of flushing those sewers?

(*The Mayor.*) There has been flushing with an immense quantity of water.

(*Mr. Wilds.*) They have been flushed from the hydrants, but my proposal was to throw in a large body of water at the end of the main sewers.

The witness withdrew.

Mr. John Glass (Enfield Lock) examined. *Mr. J. Glass.*

4730. (*Chairman.*) What are you?—I am traffic manager for the River Lee Trustees.

4731. How long have you been their traffic manager?—For the last 14 years. I have been connected with the river Lee trust for 27 years.

4732. Is the traffic upon the river a growing one?—It is very much so.

4733. Has it been a growing traffic in spite of railway competition?—It has.

4734. Have the railways at all tended to diminish the traffic on the Lee?—To some extent they have upon some articles, but it has increased upon others.

4735. In what has the traffic diminished?—Principally in coal.

4736. And in what has it increased?—In building materials, and grain and malt; grain of every description.

4737. Is that because you give better accommodation than the railway can give to take the articles nearer to the place where they are wanted, and so nearer to the place where they are to be removed from?—Yes; and because we can do it cheaper in very large quantities.

4738. Have you any written statement which you can put in of the progressive increase of the traffic, and the income from that traffic?—I will put in a statement for the last eight years, showing the amount of tons charged and the amount of tolls collected.

4739. This is a statement of traffic on the river Lee during the last eight years. In 1858 you carried 254,269 tons, including 22,171 tons of manure, and received 8,104*l.*?—Yes.

4740. And the last year, 1865, you carried 373,357 tons, including 23,896 tons of manure, and you received 10,431*l.*?—Yes.

4741. In 1862, which was a maximum year, I find that you carried 474,630 tons, including 119,111 tons of manure, and that you received 10,526*l.*?—Yes.

4742. It would appear that the excess of tonnage there had been in something which did not pay very much, for there is not a difference of 100*l.* between the amount received in that year and the amount received in 1865?—Just so.

(*The Mayor.*) That was manure.

4743. (*To Mr. Glass.*) And the carriage of manure was stopped after the cattle plague set in?—Yes. In the year 1862 large buildings and works were going on in the neighbourhood of Homerton at the East London Waterworks, and that caused a great increase at that point, but this year the amount of tolls received will be considerably more than in 1862.

4744. From what will that arise?—The general increase of traffic; there is no one particular thing; there are building materials of every description and also materials for brick making.

4745. Do you, in the course of your occupation, go much up and down the navigation?—Constantly.

4746. In what state should you say that it is now as regards the banks, and the locks, and the waterway?—Very good.

4747. Have you anything to do with the dredging?—Yes, a great deal; we realize a considerable profit by the dredging.

4748. Have you charge of the dredging operations?—Yes.

4749. Have you had occasion to complain of any pollutions poured into the navigation at any particular points?—That perhaps would be a matter more for the engineer; so long as the water is sufficient to carry the barges up and down I do not interfere much about the quality of it, unless there is any obstruction in the navigation.

4750. You think that dirty water will carry coals as well as clear?—Exactly.

4751. Has the water been at all offensive to you at any time?—Not above Tottenham.

4752. But below Tottenham?—Below Tottenham, very much so.

4753. That is below where the East London Waterworks Company takes its water supply?—Yes.

4754. (*Mr. Harrison.*) As to the traffic upon the

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canal, is that traffic which you have given in distributed throughout the whole length of the canal?—Throughout the whole length of the navigation from London to Hertford, beginning at Limehouse cut, Bromley, Old Ford, part of Homerton, Lee Bridge, Clapton, Tottenham, Edmonton, Ponder's End, Enfield lock, Waltham, Cheshunt, Broxbourne, Hoddesdon, the river Stort navigation, Stanstead, Ware, and Hertford, and at all those places there is an abstract showing the different articles carried, ashes, breeze, chalk, sand for brick making, coals and coke, building materials, cement, stone, iron, and timber, gravel, linseed cake and oil, and linseed for making the cake, barley, and oats. Immense quantities of barley are taken up to be converted into malt. Wheat is taken up to the mills and ground, and sent back again as flour. Flour is carried both up and down; flour is brought from the mills, and foreign flour is carried up in casks. Beans, peas, tares, and every description of grain are carried. Immense quantities of malt are carried, last year there were 26,653 tons of malt carried from Ware only; that multiplied by eight would give you the number of quarters.

4755. (*Professor Way.*) Is that at 1*s.* 3*d.* a ton?—At 1*s.* a ton.

4756. (*Mr. Harrison.*) Besides the traffic to those places which you have mentioned, do you afford accommodation for mills and wharves in between?—Yes. The mills at Hertford keep barges (I am speaking of the flour mills), and they convey the wheat up and grind it, and send the flour again to London in a barge.

4757. Do you know of any railway of the same length with accommodation to such an extent as is afforded throughout the length of the river Lee?—There is nothing like it I should think on any railway in England.

4758. (*Chairman.*) What is the difference between breeze and ashes?—The ashes are the sifted material and the breeze is the coarse material.

4759. Then the breeze is just as you get it from the ashpits in London?—It is the coarse parts sifted from the ashes; the breeze is used for burning the bricks, and the ashes are used for mixing with them, when they make them; the fine part of the ashes is mixed with clay in making the bricks, and the breeze is put into the stack to burn them.

4760. When the dustmen cart the mass from the London dustbins, what would you call it?—The dust.

4761. When you have sifted it the one portion is called breeze and the other is called ashes?—Yes.

4762. The fine portion is called ashes?—Yes.

4763. And the coarse portion is called breeze?—Yes.

4764. (*Mr. Harrison.*) Is the return which you have put in a return for a twelvemonth?—Yes.

4765. (*Professor Way.*) It gives 373,000 tons for the year 1865?—Yes.

4766. That is in both directions, up and down?—Yes.

4767. (*Chairman.*) Can you give us a copy of that return?—I will do so. (*The witness subsequently furnished to the Commissioners a copy of the return, which will be found printed at the end of his evidence.*)

4768. (*Mr. Harrison.*) Do you find that manufactories are being established on the banks of the navigation in consequence of this accommodation which you can give them?—Very much so. In the case of any new factories established in the suburbs of London the parties generally apply to the trustees of the river Lee navigation for land on which to erect the factories.

4769. How far from Bow creek up the navigation does the establishment of factories extend?—To Ponder's End, about nine or ten miles.

4770. Therefore any interference with the navigation would not only injure the property of the navigation but would seriously injure a considerable amount of property on the bank?—Yes; the property established on the banks in old and new factories and warehouses and malthouses is immense; that property is far before the property of the trustees.

4771. When you carried the manure, before the cattle plague broke out, did you find it pretty equally distributed throughout the length of the navigation?—We put all the restrictions which we possibly could upon the manure as far as the law would allow us. We prevented its being landed on the trustees property or across the towing-path, but still a certain amount was carried up which we could not prevent; it was taken up the back rivers. I am speaking of the time during the cattle plague.

4772. Generally speaking, apart from the cattle plague, you do not discourage it?—No.

4773. Is it distributed upon the navigation right and left throughout the whole length?—It generally begins about Ponder's End and goes all the way up to Hertford to different points, Ware and Stanstead, and many parts between the towns, where the agriculturists have land; they bring a barge alongside and carry it at once upon their land; that is the case up the Stort.

4774. Then that is a very great accommodation to the neighbourhood?—Yes; in many places they would not be able otherwise to get it upon the land at all; it is too marshy to cart it.

4775. (*Professor Way.*) I see that last year you carried altogether 349,000 tons of the articles given, and 23,000 tons of manure besides that?—Yes.

4776. These 23,000 tons compared with 349,000 tons of other articles, make about one-sixteenth of the whole, which goes without charge?—Yes. I was going to enumerate the different towns where factories are established on our banks. At Enfield lock there is the large gunmaking establishment, and at Waltham Abbey there is the government powder establishment; they keep barges of their own, locked up barges, in which they send their powder to their stores at Purfleet.

4777. Do they pay you any rate?—Yes, they pay for it, but they could not send their powder except by water; it would be dangerous to the public.

4778. Do they pay you an exceptional rate for it?—They pay the highest rate which we can charge, which is 1*s.* 1*d.*

4779. (*Chairman.*) Is it your duty to make yourself acquainted with the rates charged by the railway company, and to advise your principals of what rates are current in the district for the different kinds of goods?—No, we are not carriers; the railway company are carriers.

4780. Who are the persons generally who carry upon your navigations, are they carrying companies, or proprietors owning their own barges?—Most of them own their own barges; a great many in the lower part of the district are principally lightermen, who have barges of their own, and who work by the job.

4781. Lightermen are persons who may possess from one to a hundred of these lighters or barges?—Exactly so.

4782. And they navigate the Thames as well as the river Lee?—Yes.

4783. And they take up and put down cargo according to their own freightage scale?—Yes.

4784. How do you ascertain the tonnage which they carry?—By gauging; the system is the same as is in operation on all the inland canals, such as the Grand Junction canal, and the Regent's canal.

4785. Do you compel them to have a floating gauge plate, which you can read, on the stem and stern?—No, it is in a different way; we have a gauging rod which we put on the side of the barge, which shows the number of dry inches, that is to say the number of inches from the gunwale of the barge to the water's edge. First of all we have a table made, and according to the number of dry inches and decimal parts, we find the tons by the table.

4786. The boats are registered to carry according to the depth and draught, and you ascertain the draught, and accordingly register them for the tonnage?—Yes.

4787. So far as your knowledge goes, do you think that that is a pretty fair way of ascertaining the tonnage?—It is the most correct mode that can possibly be adopted.

4788. Can you get the tonnage of a 100 ton barge within 5 tons?—Within 5 lbs.

4789. (*Mr. Harrison.*) As each new boat is introduced on to your navigation, do you put it on to a lock or pound, and load it, and see what depth it draws with each additional foot?—We do not take the depth of water, but we take the dry inches, because the depth of water is liable to fraud by putting on pieces at the bottom to make it appear deeper, and it is not always in view. We first of all put on four plates; we measure the extreme length of the barge, and then take the stowage, and divide the stowage into four, and put four plates on, two on each side. We take the dry inches before we put anything into the barge, and according to the size of the barge we have regular weights, 2 cwts. each, which we put in until we have loaded her down to 60 tons, or as deep as is necessary, and then we make a table. A copy of that table is sent to all the collectors on the navigation, and by that means we get at the tonnage as correctly as anything can be got at.

4790. (*Chairman.*) If you measure by tens of tons, the intermediate space for decimals of tons you divide into decimal parts?—Yes.

4791. If it was 4 feet 3 inches and $\frac{1}{10}$th you would know exactly what it meant, although you had not measured the tenth in the arrangement?—If we put in 8 tons we should see what the difference was, and should then divide it by 8. We find that the barges sink from 45 $\frac{1}{100}$ths to about 55 $\frac{1}{100}$ths of an inch to a ton.

4792. (*Mr. Harrison.*) I suppose that you feel the effects of competition through the haulers; if they find that they are losing their traffic by the railway company lowering their rates, they will come to you and let you know, and ask you to reduce your rates?—Yes; it is our interest as much as possible to co-operate with the traders.

4793. (*Chairman.*) Have you anything to do with the maintenance of the banks?—That is more a question for the engineer.

4794. And for the bank manager?—Yes; I have to do with that matter, but it is under the direction of the engineer.

4795. Do you know what is the net income of the trust at present for paying dividend, after paying salaries and maintenance?—No.

4796. (*To Mr. Marchant.*) Do you know whether you have a surplus income, whether you have more than you require, or less than you require?—At the present moment I believe that we have something more of revenue than of expenditure.

4797. (*Professor Way.*) Is that after paying current works out of revenue?—No; we distinguish between ordinary and extraordinary expenditure, that is to say, revenue and capital.

4798. If you have used up your capital, how do you provide for current works except by increasing your debt?—We do not; if we required more money on capital account, we should immediately issue more debentures.

4799. (*Chairman.*) You have not gone to your limit?—We have not.

4800. (*Professor Way.*) You do not use your revenue for new works?—No.

4801. (*Chairman.*) Have you a public audit?—No; we have an auditor appointed, in fact, our deputy chairman, *ex officio* auditor.

4802. Is he appointed by your own board?—Yes.

4803. You have no external authority to which you refer the account?—None.

4804. Do you not think it advisable if you had additional power, that there should be some independent board to whom you should have to refer your audit?—I can quite conceive that if you were to extend the powers of the trust, and to raise funds by means of rating, or any other means, it would be desirable to have a public audit.

4805. That is to say, that your accounts should be submitted to an independent authority, such as the Board of Trade?—Yes.

4806. And that persons who considered that they were interested, should have the power of making an examination?—I may say, that the accounts are public to this extent, that if any person interested in the navigation desired to have a copy of our accounts, or to look at our books, we should not hesitate for a moment in letting him do so; for copies he would have to pay to the clerk the charge which is mentioned in the Act. The accounts are, therefore, public to that extent.

4807. Then you have a provision in the Act by which any person directly interested in the navigation can ask to have a copy of the accounts?—Yes.

4808. (*Professor Way.*) He could demand it, at all events, he could get an order from the Court of Chancery to see the accounts?—Certainly. We have always an annual meeting in the city of London, at which the accounts are passed, and a statement is placed before the trust.

4809. (*Chairman.*) Your trust is composed of such a variety of interests, that in fact, it amounts to a public audit, because you have so many interests involved in the constitution of the trust?—That is so, the trust is, in fact, essentially a public trust; it is a public commission, the members of that commission being chosen from the localities of the different counties and boroughs through which the river passes.

4810. (*Professor Way.*) There is nothing to prevent us from getting a statement of your receipts and disbursements for the last 10 years?—Certainly not.

4811. (*Chairman.*) Are your annual accounts published, and is a printed copy submitted to each member of the trust?—Not as a rule, but if a member asks me for a copy I gave it to him, they are not sent round as a rule.

4812. You do not necessarily publish and send round the accounts?—No. For instance, there may be *ex-officio* members who have not attended the meetings for a considerable period, and we do not take the trouble to send the accounts to a gentleman who takes so little interest in the affairs of the trust, and the result of our operations; but if any member should happen to write to me for a copy of the accounts, it is sent to him immediately.

4813. (*Professor Way.*) Will you let us have a copy of your receipts and disbursements for the last 10 years?—Certainly.

4814. (*Chairman to Mr. Glass.*) Have you anything to add to your evidence?—Not that I know of, except that I wish to show that the river Lee navigation is a greatly improving navigation, and will be year by year increasing in every direction, and for this reason, namely, that London is spreading out far away, and getting towards the nearest mode of conveyance of heavy materials for building and so on. The trustees have a large quantity of land on the side of the navigation at the marshes at Homerton, in a few years that land will be all built over with large factories, which will be increasing the traffic upon the navigation. Within the last 12 or 14 years the trustees have been improving the navigation and laying out an immense sum of money in widening the locks, so as to admit barges of a larger capacity from the Thames which could not come up before, also barges which travel on the Regent's canal where the locks are wider than

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ours. Barges of any width which traverse the Thames are now enabled to come up to those lower points where these manufactories are likely to be established. I may add that I find that at Ware and Hertford the malting trade is gradually and progressively increasing.

4815. Have you any pleasure boats upon the river in any portion of its course?—Yes, we have a great number of pleasure boats down below Tottenham.

4816. Do they pay any rate to the trustees?—Not unless they come through the lock; some of the owners of these boats pay a small sum per annum for the privilege of keeping their boats over a certain area near the towing-path, so that they should not be interferred with by others.

4817. Have you any idea what number of pleasure boats ply upon the river in the different branches?—I should think that there are 500 or 600 pleasure boats.

4818. Seeing that you have to maintain the river, should you think it any hardship if you had the right of putting a rate of 10*s.* or 1*l.* a year upon the pleasure boats?—Wo do that to a certain extent in the cuts, and I think that it would be a very excellent thing if we had power to do so on the old river between Tottenham and Lee Bridge, for those boats are a very great nuisance.

4819. You think that a person who could afford to keep a pleasure boat would not object to a moderate payment?—No.

4820. It might be a great advantage to you and might enable you to keep the river in a better condition?—Yes. They always pay for passing through a lock. They do not keep the pleasure boats for their own use, but they keep them for hire.

4821. In that case do you not think that it would be fair and reasonable that you should have the power of levying a rate upon them for a licence, an annual or quarterly payment?—Yes.

4822. If you made them take out a licence at 5*s.* a quarter or 1*l.* a year, you would have a small income from them, and it would do them no very great harm, and it would do you some good?—Yes; we do adopt that principle in the cuts and in some places below where they wish to lay alongside our towing-path, we charge them 10*s.* per boat per annum, and it gives us some little control over the matter.

(*Mr. Beardmore.*) There is no doubt that many of those boats are most dangerous and there ought to be a registration of them.

4823. (*Professor Way to Mr. Glass.*) The pleasure boats are an obstruction to the navigation?—They are a very great obstruction below Tottenham. We keep them within bounds above and have a control over them, but below Tottenham, between there and Lee Bridge, they are a very great obstruction.

4824. (*Chairman.*) Have you power to license persons for fishing?—No, we have nothing to do with the fishing.

4825. Who regulates that?—It is regulated by different parties.

4826. Private owners?—Private owners.

4827. According to arrangements which have been previously entered into?—Yes.

4828. Is there anything further which you wish to add?—There is nothing that I know of.

(*Mr. Beardmore.*) The trustees own two or three fisheries which they let.

4829. (*Professor Way to Mr. Marchant.*) Is there any reason why we should not have a return of your income and expenditure. If we are to make any recommendation we must really know what funds you have at your disposal?—It is necessary for me to have authority to give that return, and the only reason why I say that it is necessary for me to have that authority is, that the Act specifies that those persons who are interested in the navigation should have copies of the accounts; if at our next meeting, which will be on the 14th of January, I can get the authority, it will I presume be sufficient for your purpose. (*Mr. Marchant subsequently furnished to the Commissioners copies of Abstract of Accounts of River Lee Trust from* 1856–66. *The Abstract of Accounts for the year ending Dec.* 31, 1866, *will be found printed as Appendix* 3 *to his evidence.*)

4830. We have authority to call for all papers?—Yes.

The witness withdrew.

APPENDIX I. to the EVIDENCE of JOHN GLASS, Esq., Traffic Manager to the River Lee Trust (referred to supra, Q. 4767).

ABSTRACT of TRADE for the Year ending the 31st December 1865.

—	Limehouse Cut.		Bromley, Bow, and Old Ford.		Duckett's Canal.		Homerton, Lee Bridge, and Clapton.		Tottenham, Edmondton, and Ponder's End.		Enfield Lock and Waltham.		Cheshunt, Broxbourne, and Hoddesdon.		River Stort.		Rye and Stanstead.		Ware.		Hertford.		Total.	
	Tons.	Tolls.	Tons.	Tolls.	Tons.	Tolls.	Tons.	Tolls.	Tons.	Tolls.	Tons.	Tolls.	Tons.	Tolls.	Tons.	Tolls.	Tons.	Tolls.	Tons.	Tolls.	Tons.	Tolls.	Tons.	Tolls.
		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.
Ashes and breeze	120	1 10 0	18,854	235 13 6	733	17 1 0	—	—	60	1 10 0	262	6 11 0	1,008	25 4 0	342	8 11 0	60	1 10 0	3,226	80 13 0	183	4 11 6	24,848	382 14 0
Coals and coke	602	7 10 6	10,653	133 3 3	8,314¾	138 12 6	2,232½	37 4 1	3,217	53 13 4	8,284½	200 19 1	1,186	28 5 8	7,451¾	186 7 4½	791½	19 17 3	6,412	156 7 1	4,893¾	119 4 7	54,014	1,081 4 8½
Bricks and tiles	—	—	9,910	124 6 8	520¾	7 17 4	8,378¼	105 14 7	1,800¼	23 0 6	260	3 6 0	886	11 1 6	193	2 8 3	233	2 18 3	9,221	116 10 9	73	1 14 0	31,474¾	398 17 10
Chalk and sand	42	0 14 0	2,192	36 10 8	—	—	13,377	311 14 6	5,387	134 13 6	121	3 0 6	453	11 6 6	64	1 12 0	61	1 10 6	501	12 10 6	—	—	22,198	513 12 8
Cement and lime	90	1 10 0	2,481	41 7 0	45	0 15 0	2,532	62 7 2	—	—	336½	17 14 8½	—	—	6	0 7 6	6	0 7 6	31	1 12 1	64	4 0 0	5,591½	130 11 11½
Slates	—	—	—	—	—	—	438	10 5 8	—	—	42	2 2 0	—	—	281	14 1 0	—	—	40	2 0 0	78	3 18 0	869	32 6 8
Stone	12	0 4 0	480	8 0 0	55	1 1 8	318	6 10 6	1,742	43 11 0	11	0 11 0	—	—	183¾	9 3 9	10	0 10 0	197	9 17 0	230	11 10 0	3,238¾	90 18 11
Timber	963	16 1 0	4,104	68 8 0	293½	4 17 10	983	22 13 10	1,561½	39 0 9	930	44 12 8	113½	5 13 6	1,552	77 2 0	131½	6 11 6	781	38 11 0	834½	41 14 6	12,247½	365 16 7
Iron	10	0 3 4	100	1 13 4	748¾	12 17 1	160	3 18 0	1,229	30 14 6	337¾	16 5 9	—	—	47½	2 7 6	—	—	—	—	39	1 19 0	2,672	70 18 6
Gravel and road materials	—	—	—	—	54	0 13 6	891	22 5 6	1,918	47 19 0	75	1 17 6	25	0 12 6	125	3 2 6	—	—	75	1 17 6	—	—	3,163	78 8 0
Linseed cake	240	4 0 0	2,447	40 15 8	444	7 8 0	—	—	—	—	68½	3 8 6	5	0 5 0	3,130¾	156 10 9	—	—	792½	39 12 6	274	13 14 0	7,401¾	264 14 5
Oil	628	10 9 4	7,062	117 14 0	59½	0 19 10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	974¾	48 14 9	8,724½	177 17 11
Barley and oats	—	—	—	—	5	0 1 8	—	—	6	0 3 0	1,352	65 10 3	117¼	5 17 3	4,349	217 9 0	30	1 10 0	6,242	312 2 0	2,288	114 8 0	14,380¼	717 1 2
Wheat	—	—	—	—	—	—	—	—	3,160½	79 0 3	2,731	134 14 4	1,587½	77 5 0½	6,173½	309 3 6	653½	32 13 6	1,339	66 19 0	708	35 8 0	16,363	735 3 7½
Flour and meal	—	—	—	—	82	1 17 10	—	—	403½	10 1 9	818¼	25 13 10½	1,591¾	40 3 7½	2,214¾	64 18 7½	98¾	2 9 4½	396¼	11 4 9	41½	2 1 6	5,646¾	158 11 4
Seeds, Beans, peas, tares, and rye	130	2 3 4	10,166	169 8 8	—	—	—	—	—	—	190	9 3 8	89	4 9 0	461	23 1 0	—	—	392½	19 12 3	5,786½	289 6 6	17,214½	517 4 5
Malt	—	—	—	—	—	—	—	—	—	—	50	2 10 0	—	—	20,674½	1,033 14 6	2,199	109 19 0	26,653½	1,233 3 6	1,348½	67 8 6	50,925½	2,546 5 6
Boats	—	6 17 6	—	10 7 6	—	—	—	1 12 0	—	—	—	41 0 0		7 2 6	—	—	—	—	—	0 18 9	—	0 5 0	—	68 3 3
Empty barges	—	17 5 0	—	269 10 6	—	103 13 0	—	123 15 0	—	64 10 0	—	58 13 0		21 18 0	—	51 15 0	—	8 11 0	—	80 17 0	—	21 3 0	—	821 0 6
Sundries	5,707	95 2 4	23,535	392 5 0	11,087½	177 14 11	13,427	189 13 0	1,615	25 7 6	1,263½	63 13 8½		1 14 5	109¼	6 16 6¾	23½	1 9 4½	58½	3 13 1½	170	10 12 6	56,427¼	969 2 5¼
Saltpetre and gunpowder	—	—	—	—	—	—	—	—	—	—	1,564	84 14 4			—	—	—	—	—	—	59½	3 4 5½	1,623½	86 18 9½
Flints, chalk, gravel, sand, and roots, *downwards*	—	—	—	—	904	8 10 8	113	0 18 10	—	—	976	8 2 8	103	0 17 2	—	—	50	0 8 4	7,975	66 9 2	577	4 16 2	10,698	90 3 0
Wharfage	—	—	—	15 16 1	—	—	—	—	—	4 17 0	—	112 18 8	—	—	—	—	—	—	—	—	—	—	—	133 11 9
Total tons charged	8,544	163 10 4	91,984	1,664 19 10	23,346¼	484 1 10	42,849½	898 12 8	21,499¾	558 2 1	19,673	907 3 2½	7,196	241 15 8	47,361¾	2,168 11 9¾	4,350¾	190 5 7	64,333	2,354 10 11½	18,622½	799 13 11½	349,760½	10,431 7 11¼
Manure	568	—	10,353	—	191	—	510	—	2,261	—	808½	—	1,605	—	4,786	—	—	—	2,035	—	478	—	23,596½	—
Total	9,112	—	102,337	—	23,537¼	—	43,359½	—	23,760¾	—	20,482½	—	8,801	—	52,147¾	—	4,350¾	—	66,368	—	19,100½	—	373,357	—

(Signed) JNO. GLASS, Traffic Manager, R.N.T.

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Mr. J. Glass.

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Appendix No. 2 to the Evidence of John Glass, Esq., Traffic Manager to the River Lee Trust.

Rates of Tonnage, Table of Distances, and List of Barge Owners.

The River Lee is navigable for craft coming from the lower part of the Thames and the river Medway at Blackwall, through Bow Creek; and from the upper part of the Thames at Limehouse through the Limehouse Cut to Bromley, Stratford, Bow, Old Ford, Homerton, Clapton, Lee Bridge, Walthamstow, Tottenham, Edmonton, Ponder's End, Enfield Lock, Waltham, Cheshunt, Wormley, Hoddesdon, Stanstead, Ware, and Hertford.

The locks are now calculated to admit barges of 90 feet in length to any point, and of the following width, viz.:—

To any point short of Old Ford lock, 20 feet wide.

To any point short of Ponder's End lock, 17 feet wide.

To any point short of Enfield lock, 15 feet wide.

To all points beyond, and the "Stort," 13 feet 3 inches wide.

Junctions with Canals and Railways.

The navigation is connected with the Regent's Canal through the Hertford Union or Duckett's Canal at Old Ford, opening a direct communication with the Grand Junction and all canals and railways north of London.

It also joins the Stort navigation at Hoddesdon, extending to Roydon, Harlow, Sawbridgeworth, and Bishop Stortford.

In the Limehouse Cut there is a coal shoot where craft may load direct from the North London in connexion with the North Western and other lines of Railway. Also at Hertford, a capacious dock and wharf adjoining the Great Northern Railway.

The navigation is open for traffic at all times, night and day, except Sundays, when it is closed from eight o'clock in the morning until 6 in the evening.

River Lee Trust.—Rates of Tonnage.

Goods.	London Trade. To or from the Thames, the Regent's Canal, and the following Points, viz.:—								Local Trade. To or from Hertford, Ware, or the Stort, and				Local Trade. To or from Cheshunt, Waltham, or Enfield Lock, and			
	The Limehouse Cut only.		Junction of the Duckett's Canal, Old Ford, and Homerton.		Lee Bridge, Tottenham, Edmonton, and Ponders End.		Enfield Lock, Waltham, and Cheshunt.		Broxbourne, River Stort, Stanstead, Ware, and Hertford.		Waltham, Cheshunt, or Enfield Lock.		Ponders End, Edmonton, Tottenham, Lee Bridge, or Duckett's Canal.		Ponders End, Edmonton, Tottenham, or Lee Bridge.		Homerton. Duckett's Canal, or Old Ford.	
	Per Ton. s.	d.	Per Ton. s.	d.	Per Ton. s.	d.	Per Ton. s.	d.	Per Ton. s.	d.	Per Ton. s.	d.	Per Ton. s.	d.	Per Ton. s.	d.	Per Ton. s.	d.
Tiles, chalk, sand, and gravel and road materials (upwards)	0	4	0	4	0	6	0	6	0	6	0	6	0	6	0	6	0	6
Ashes, breeze, and coke	0	3	0	4	0	6	0	6	0	6	0	6	0	6	0	6	0	6
Coals	0	3	0	4	0	4	0	6	0	6	0	6	0	6	0	6	0	6
Grain, seeds, malt, oil, linseed cake, iron, slates, stone, timber, and flour and meal (upwards	0	4	0	4	0	6	1	0	1	0	0	7	1	0	0	6	1	0
Cement, lime, and sundries	0	4	0	4	0	6	1	1	1	3	0	7	1	3	0	6	1	1
Saltpetre and gunpowder	0	4	0	6	0	6	1	1	1	9	0	7	1	3	0	6	1	1

Bricks or spoil, to or from any point, 3*d.* per ton.

Coals, from Duckett's Canal to any point, or from Hertford to the Thames, not to exceed 4*d.* per ton.

Flour (downwards only), not to exceed 6*d.* per ton.

Rough iron ore, from Hertford to the Thames, 3*d.* per ton.

Empty barges, and barges not having paid toll to that amount, 3*s.* each.

Pleasure boats 1*s.* 3*d.* each, to be paid at the first lock they pass through up or down.

Flints, chalk, gravel, sand, roots, vegetables (downwards only), 2*d.* per ton.

Goods that have not paid tonnage will be charged 1*d.* per ton for wharfage, if landed across the towing path.

Barges not paying toll will be worked through the Bow Tidal Lock at a charge of 1*s.* each way.

Pitch, tar, creosote, and gas products, passing through Old Ford only, 3*d.* per ton.

Wharfage, in Hackney Marsh, for all goods except manure, 3*d.* per ton.

Wharfage, at same place, for manure, 15*s.* per barge.

Ware wharf is open free of toll except for manure, chalk, sand, and gravel, &c., which will be charged 2*d.* per ton, and 1*d.* per ton additional for each week or part of a week that the articles may lay upon the Wharf after the first week.

All articles will be charged by the gauge or actual weight o 20 cwt. to the ton.

The above tolls will be charged until further notice.

By order of the trustees,

J. Marchant, Jun., Clerk.

Hertford, June 1865.

Table of Distances between Hertford and the Thames at Limehouse, in Miles.

	Hertford	Ware	Stanstead	Hoddesdon and Stort	Broxbourne	Cheshunt and Wormley	Waltham	Enfield Lock	Ponder's End	Edmonton	Tottenham and Walthamstow	Lea Bridge and Clapton	Homerton	Old Ford and Duckett's Canal	Stratford, Bromley, and Bow
Hertford		3	6	8	11	14	16	18	20	22	24	27	29	30	31
Ware	3		3	5	8	11	13	15	17	19	21	24	26	27	28
Stanstead	6	3		2	5	8	10	12	14	16	18	21	23	24	25
Hoddesdon and Stort	8	5	2		3	6	8	10	12	14	16	19	21	22	23
Broxbourne	11	8	5	3		3	5	7	9	11	13	16	18	19	20
Cheshunt and Wormley	14	11	8	6	3		2	4	6	8	10	13	15	16	17
Waltham	16	13	10	8	5	2		2	4	6	8	11	13	14	15
Enfield Lock	18	15	12	10	7	4	2		2	4	6	9	11	12	13
Ponder's End	20	17	14	12	9	6	4	2		2	4	7	9	10	11
Edmonton	22	19	16	14	11	8	6	4	2		2	5	7	8	9
Tottenham and Walthamstow	24	21	18	16	13	10	8	6	4	2		3	5	6	7
Lee Bridge and Clapton	27	24	21	19	16	13	11	9	7	5	3		2	3	4
Homerton	29	26	23	21	18	15	13	11	9	7	5	2		1	2
Old Ford and Duckett's Canal	30	27	24	22	19	16	14	12	10	8	6	3	1		1
Stratford, Bromley, and Bow	31	28	25	23	20	17	15	13	11	9	7	4	2	1	
Limehouse	32	29	26	24	21	18	16	14	12	10	8	5	3	2	1

The distance from the mouth of Bow Creek at Blackwall is about one mile further than from Limehouse; and the distance on the Stort navigation from its junction with the river Lee at Hoddesdon to Bishop Stortford is 13 miles.

Mr. Alfred Manser (Hoddesdon) examined.

4831. (*Mr. Harrison.*) Where do you live?—At Hoddesdon, on the Lynch, which runs into the Lee.

4832. Do you carry on any occupation there?—I am a miller, a barge owner, and a coal merchant.

4833. Have you more than one mill?—I have two mills, one on the Lynch and the other on the Lee.

4834. Of what power are those mills?—At one mill we have a guaranteed power of 4,000 cubic feet of water per minute.

4835. Which mill is that?—That is the one on the Lee.

4836. What is your fall there?—5 feet.

4837. What is it at the mill on the Lynch?—12 feet.

4838. Does the water originate with you?—It springs on our own premises.

4839. Have you found any difference in the volume of water discharged from that spring of late years?—I have not measured it.

4840. You have not found any sensible diminution in the power of your waterwheel?—No, I cannot say that I have.

4841. It was mentioned to us at Bishop Stortford that in many cases the water power had considerably diminished. Your mills are flour mills?—Yes.

4842. Do you use the navigation for carrying your corn and flour?—Yes, almost entirely.

4843. Do you find it a convenience?—A very great convenience; the rail would be very inconvenient to me, I could not work with it.

4844. So that any interference with the navigation would be a decided disadvantage to you?—It would make the mills comparatively worthless; at one mill I should be three miles from the railway station.

4845. How far are you below Ware?—We call it four miles. Charlton mill is the first mill below where the Stort enters.

4846. Do you find any nuisance arising from the waters of the Stort, or of the Lee?—No; our foreman at the Charlton mill cottage always uses the Lee water for drinking and cooking, and so they do at the "Fish and Eels" public-house.

4847. Without filtration?—Without filtration. I do not think that our foreman has a filter. I drink the water myself, occasionally.

4848. Do you see much difference between the water now, and in former years, as to its purity?—I do not think that it is quite so pure as it was; that is speaking of above me as far as it comes down to me; below it certainly is not so clear.

4849. The benefit of the navigation to yourselves would be equally felt by millers situated upon the river, and other persons, throughout its length?—Yes, maltsters and millers, seed crushers, and every one. I consider it of very great value; in fact, it is that which makes Hertford, and Ware, and Waltham Abbey what they are.

4850. You think that the railway will not do for those towns what the navigation does?—No, certainly not. In my own case I can get a sack of flour conveyed by the navigation for 3*d.*, if I send it to the rail I must pay 6*d.*, and I must first get it to the rail.

4851. Have you any steam power?—No, there is a steam engine put up by the New River Company to make up the quantity of water which they have to supply in dry seasons; they have to supply us with a certain quantity of water, or to forfeit 10*l.* a day. We have to give them notice.

4852. When was that engine erected?—I think in 1855, just after the last Act.

4853. In how many instances have you had occasion to call upon them to use it?—That has been the case most years; it was so in last year, and the year before. I should think that it has been at work eight years out of ten.

4854. In 1864 for what length of time was it used?—I think that it was at work about two or three months.

4855. And in 1865?—About the same time. In 1864 I think that it was at work three months, and in 1865 two months.

4856. Of what horse power is it?—They call it, I believe, 40-horse nominal power. The engine pumps the water. They have centrifugal pumps; we would not allow them to put it up at the mill. The New River Company were to provide a certain quantity of water by pumping or otherwise, and we said, "Provide it by pumping."

4857. You would rather have a regular steady action of the waterwheel than steam power?—Yes, decidedly.

4858. (*Chairman.*) They pay 1*s.* every time they pump for nine pennyworth of power?—I believe that if that engine was worked up to 45-horse power it would only do about 8-horse power of work; they lose 10*d.* out of the 1*s.*

4859. Or more than that?—Yes.

4860. (*Professor Way.*) Would it not seem the most reasonable way for you to take some compensation?—We fought it out rather hard and we died hard.

4861. (*Mr. Harrison.*) What is your opinion as to the value of the navigation for the powder works, and the small-arms factory?—I do not think that the powder works could be carried on without it. The way in which they manage is to work small boats upon the cuts, and they take the charges to the various magazines, so that it is not necessary to use a cart or a truck; there is no friction and no danger, and as soon as they have 500 barrels of powder it is sent away to Purfleet.

4862. (*Chairman.*) They can isolate themselves?—Yes.

4863. (*Professor Way.*) They were put there for the very purpose of that being the mode of transit to the depôts?—Yes.

4864. (*Mr. Harrison.*) How do you think that the present river Lee trust works for the benefit of the public?—I think that it worked better when there were a greater number of men of business upon it.

4865. (*Chairman.*) Is there anything to prevent your being a member of the trust?—No, if I choose to qualify; you must have a certain amount of income derived from freehold property.

4866. (*Mr. Harrison.*) Is there any exclusion of millers from the trust?—No, I should have qualified, but I do not quite like the way in which they manage things.

4867. Would not the best thing for you to do be to get on the board and induce them to manage better?—I very much doubt that. I am the secretary of an association which has been formed, to endeavour as much as we can to keep them in their places.

4868. (*Mr. Harrison.*) How does that association act upon them?—I think that, for instance, in the case of the Regent's Canal Bill, which was brought forward two years ago, it acted beneficially; it stirred them up, and pushed them forward to do their duty.

4869. How is it that the men of business are not upon the board now?—Some years ago there was a great change in the management of things. A vice-chairman and a great number of county gentlemen were introduced, and it did not appear that there was that amount of attention paid to the wishes of men of business which there had been, and consequently I think that in most cases they declined to attend and others declined to become fresh members. We have no court of appeal; for instance, if I went to-morrow and said, "So-and-so is wrong," it is possible that I might be heard, and in all probability I should be heard, but in the event of my not getting any redress there would be nowhere for me to go.

4870. (*Chairman.*) Then do you think that there should be some superior board to whom you could appeal?—Yes, I think that if there were two or three commissioners before whom we could lay any case of complaint, in case we could not obtain redress from the board, it would act extremely well.

4871. Do you think that if the trust was to be

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extended in its operations into a conservancy board, the Government in granting that power should place some sort of check or control, or should establish a court of appeal to which persons thinking themselves in anyway aggrieved could have recourse?—Yes, I think that there should be a superior board.

4872. (*Professor Way.*) But I take it that you would not like the present trust in any form unless it was considerably modified by the admission of a large business element?—I think so.

4873. (*Mr. Harrison.*) Is the Regent's Canal Company much interested in the Lee navigation?—As a navigation I do not think that it is now, because the communication was cut off two years ago, that is to say, the communication between the Regent's canal basin and the Limehouse cut; it was cut off at the Coffer dam in consequence of their losing their bill, and having to give up property which they had held for many years, they held it for 12 years, and we got it away again.

(*Mr. Beardmore.*) A very large traffic is carried on from the Regent's canal through Duckett's canal.

4874. (*Chairman to Mr. Manser.*) Have you ever preferred a complaint which the trust has not dealt with?—I have.

4875. What was that complaint, and when?—It is now a good many years ago; it was with regard to the reconstruction of a weir, and its water-marks.

4876. Has it not been reconstructed to this day?—It was reconstructed, but I did not get what I wanted. I had no appeal; the matter was not fairly gone into to say whether I was right or wrong; the thing remained in *statu quo.*

4877. The trustees had power to deal with it in their own way, and you think that they did not consult your interests?—Yes, but I do not make a charge against them, that is not my object.

4878. (*Mr. Harrison.*) Do you admit the general statements which we have had given in evidence to-day, namely, that under the present management and since the passing of the Act in 1855, the canal has been much improved, and the locks have been made good, and the canal has been deepened so as to take barges of nearly 100 tons instead of 40, and that accommodation is given so as to encourage an increase of the traffic to a very considerable extent upon the navigation?—I believe so in every respect. I am perfectly satisfied with it, so far as regards the actual improvement of the navigation.

4879. Therefore so far as the substantial interests of the public are concerned, the present trust appears to be working well?—Yes, so far as the public are concerned.

4880. Would your complaint be an individual one?—I think that if they paid more attention to economy and exercised more care, and if instead of borrowing a large amount of money and raising these debentures, they endeavoured to be careful to improve the river out of income, which they might very properly do, it would be very much better.

4881. Do you think that if they had confined their attention to doing works of that kind, you would have had the benefit of the present improved navigation?—We perhaps might not have had it quite so quickly, but still it is progressive.

4882. (*Chairman.*) Within the last two years, did not a memorial proceed from the association, of which you are the acting secretary, and was it not sent to the river Lee trustees, begging them to reconstruct the Limehouse entrance, it involving an outlay of something like 15,000*l.*?—Yes, but I do not think that it was necessary that they should borrow the money, because I think that if greater economy had been practised for 10 or 12 years previously, that money would have been saved, and need not have been borrowed.

(*Mr. Marchant.*) We are not enabled to create a surplus capital fund. If we had a large fund in hand applicable to such a purpose, as the memorialists requested of us, we should have to reduce our tolls. We must improve the river from year to year; we cannot make a fund for 20 years, which shall repay a possible expenditure 20 years hence. If any extraordinary work, such as that of the Limehouse entrance, is forced upon us by an association, or by extensions of business, we must borrow the money by the powers of the Act.

4883. I presume that the association in their application to the Lee trust, represented what the trade required, or the trust would not have been coerced into making that outlay?—There was no coercion. When the trade represent such a matter to us we carry it out if it is needed. This memorial was a recommendation; it was not antagonistic to us at all.

4884. (*Mr. Harrison to Mr. Manser.*) Do you know the condition of the land in the valley of the Lee, below the point where your mill is?—Yes.

4885. Is it liable to be flooded much?—Yes.

4886. Is it injured or benefited by the floods?—I should think that it is not injured. I think that the water down below in the lower part of the river is so very foul, that it manures that land rather than otherwise.

4887. Does it lie for sometime upon the land?—Generally a day or two.

4888. It lies for so short a time that it does not injure the land from the water becoming stagnant?—No; the weirs for passing off the water are better than they used to be, so that the water is passed off more quickly. Those weirs I think are all under the control of the trustees. Mr. Beardmore has introduced an iron weir in place of a wooden one, so that his posts are perhaps 6 or 7 inches instead of 14, and that increases the difference in waterway.

4889. Then that is a benefit to the neighbourhood which must be carried to the credit of the trustees of the navigation?—Yes, I will give them full credit there.

(*Mr. Beardmore.*) The improved getting off of the water is due as much to the dredging as to the other works.

4890. You have deepened the reaches?—Yes.

4891. (*Chairman.*) You have increased the sectional area through which the water can pass?—Yes.

(*Mr. Manser.*) And they have raised the banks a little.

(*Mr. Beardmore.*) The sectional area in shoal places is now at least double.

4892. That would give more than double the volume of water in the same time?—Yes; the hydraulic effect as you are aware is very much larger. I should think that it is pretty nearly eight times.

4893. (*To Mr. Manser.*) Is there anything further which you wish to bring before the Commission?—Nothing, I think, except that I do hope that any recommendation which you may make may lead to some higher power being appointed to control the acts of the trustees, and to give us justice when we seek for it.

The witness withdrew.

Mr. F. Haggar.

Mr. Franklin Haggar (Hertford) examined.

4894. (*Chairman.*) What are you?—A seed crusher and flour miller.

4895. Are you a trader having goods carried upon this river?—Yes.

4896. (*Mr. Harrison.*) Where are your mills situated?—One at the north end of the town of Hertford and the other at the west end.

4897. What power do you use for crushing?—Steam and water at one mill and only water at the other.

4898. Is your water power regulated in the same way as Mr. Manser's is?—No.

4899. Have you the control of the whole of the water of the Lee?—We have the control of the whole of the water which passes down the Lee and the

Beane. One mill is on the Lee and the other is on the Beane.

4900. Have you experienced any diminution in your power on the Beane?—Previously to this year we had a considerable diminution, consequent, I imagine, upon the small quantity of rainfall in the eastern counties generally; but this year we have had an abundant supply of water.

4901. Situated as you are at Hertford, with two railways working competitively, and the navigation, do you find that the navigation of the river Lee is a benefit to you?—I am quite certain that we should be very much worse off without the navigation; it is most desirable that it should be maintained in its present efficient state.

4902. Do you convey your goods much by the navigation?—I do not convey a great deal by the navigation because I have railway communication into one mill.

4903. Have you equal accommodation to the canal?—Yes; I can carry goods either to the river or to the railway.

4904. Were you in business here before the construction of the railways?—Yes.

4905. Do you find that you have your goods carried now at a cheaper rate than you had before the railways were constructed?—I find that I have the goods carried cheaper by railway than I had by the river.

4906. And cheaper than the river would carry them now?—Yes.

4907. Do you use much coal?—I use a large quantity of coal at the seed-crushing mill.

4908. By what conveyance do you get it?—We get it direct from the north by railway into the mill. Neither of my mills is on the navigation. I have similar accommodation, inasmuch as I can carry either to the rail or to the Lee river by land.

4909. But you have not the navigation coming close up to your mill?—I have not.

4910. You get your coal direct now from the north?—Yes.

4911. Do you get it at a lower price now than you did years ago?—I had not the mills before the railway was made, at least I had not the steam power; I had the mills but not the steam power.

4912. Is either of your mills situated below the point of discharge from the works for the purification of the sewage?—They are situated above the point of discharge.

4913. Do you find that there is any silting up in the river below your mill?—Very considerable indeed.

4914. Is it more than it used to be in former years?—I do not think that it is more than it used to be, but it is very considerable; it is getting into a very bad state indeed now.

4915. Is that below your tail race or within the navigation?—It interferes with our tail water.

4916. Is a bank formed in the tail race or in the navigation?—Not in the navigation but in the tail race, before it joins the Lee.

4917. Whose duty has it been to remove that obstruction?—I and my father before me removed it for many years, and we have commenced to remove it this year; we have taken out a large quantity, when the question has arisen as to who is entitled to the accumulations taken out of the river and thrown on to the bank; that is the question in dispute at the present time.

4918. Is it of value?—Yes.

4919. That which is an obstruction to your mill by damming up the water is really a benefit and worth taking out of the river?—Yes; but it is not worth more than the expense of taking it out. What we have to pay to take it out is about the value of it.

4920. Who disputes with you the right of taking it out?—It is not the right of taking it out.

(*The Mayor.*) We dispute your right to excavate the bed of the river.

(*The witness.*) I concede that the corporation have a right to the bed of the river, but I claim a right to take out the accumulations of soil.

(*The Mayor.*) You have done more than that.

4921. (*Professor Way to the witness.*) Supposing there is an impediment and it is removed for the purpose of obtaining power, when it is got out it may be of some value, although not equal to the cost of getting it out, then a dispute may arise as to who is to have it when it is got out?—Yes, that is the question.

4922. The dispute does not arise before it is got out?—(*The Mayor.*) Yes, we dispute it; but it appears to me that it is not a question for us to decide now, the right of Mr. Haggard to do what he has done. The fact is that he has excavated down to too great a depth; he might clear away the accumulations, but not the bed of the river.

4923. (*Mr. Harrison to the witness.*) It appears that your right to remove an obstruction is not disputed, but that your right to dredge for gravel is disputed. How many years have you known the river Lee?—All my life.

4924. What is its condition now as compared with what it was formerly?—The navigable river Lee is very much improved as a navigation certainly.

4925. What is its condition as to purity?—As to its purity it must be more pure of course as the sewage of the town of Hertford does not pass into it.

4926. Do you frequently find that dead animals are passed down the river?—Yes, dogs and cats are to be seen passing down the river.

4927. What do you do with them when they are stopped at your mill?—We pass them on.

4928. That appears to be the general practice?—We could not undertake to take them out. They come down to us and we pass them on. The river Lee above Hertford is getting into a very bad state; it is being silted up very much, and I am satisfied that the river in places is quite a foot higher than it used to be above the town of Hertford.

4929. Is the river above the point where the navigation commences under any control?—None whatever, I believe.

4930. To whom does it belong, the owners of the adjoining property?—Yes; the owners of the adjoining land have the right of fishing, and I daresay they would not let anyone come to clean it out.

4931. Are there any mills above you?—Yes, but between my mill and the mill above there is a fall, an ordinary fall in the bed of the river, which is not appropriated.

4932. The bed of the river, you think, has risen a foot within your recollection?—Quite so.

4933. Has the effect of that rising of the bed been to flood the land more than it used to be?—I have no doubt of it.

4934. Is the land in fact flooded more than it used to be in your recollection?—I should say so certainly.

4935. How far up the river does the flooding extend?—I should say for three or four miles.

4936. How far up the river is the next mill above Hertford?—The next mill above Hertford is about four and a half miles.

4937. Above that point does the miller take steps to keep the channel deep?—I do not think he does, as there is this natural waterfall that I speak of, and he is not affected.

4938. Has not the raising of the bed of the river affected the water at his mill-tail?—I think not, because of this fall, which is below his mill-tail, and it is not affected by it.

4939. What is the condition of the land adjoining the Lee above Hertford?—It is principally meadow land in the valley of the Lee.

4940. Is it in good condition?—I should say that it is generally very wet. There is land adjoining the town, or within a mile, that it is not possible to walk over; there are some acres together.

4941. Do you not think there ought to be some control over the river above Hertford to prevent the silting up of the land?—Yes, certainly.

4942. (*Professor Way.*) You are a seed crusher, are you not?—Yes.

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4943. Is it linseed principally that you crush?—Linseed, rape, and cotton.

4944. The crushing of cotton seed has only taken place, I believe, of late years?—Within the last two or three years to any extent.

4945. Do you decorticate the cotton seed?—No.

4946. You crush the whole of the seed?—Yes.

4947. In the case of the linseed, do you steam that in the first instance?—Yes, after it has been ground.

4948. You steam it and put it into presses?—Yes.

4949. What runs out besides the oil from the presses?—Nothing.

4950. What remains in the presses is the linseed cake?—Yes; there is no refuse.

4951. Is there any from the cotton seed?—None whatever.

4952. Or from the rape seed?—None whatever.

4953. If you discharge anything into the river it is only the condensed water of the engine?—Yes.

4954. How many men do you employ?—From 60 to 80.

4955. Have you any privy accommodation on your premises for your hands?—Yes.

4956. Do they drain into sewers?—No.

4957. Does the refuse pass into the river?—Yes.

4958. Except that, no other refuse is produced on your premises?—None whatever.

4959. Would it be difficult for you to get the sewage from the privies conveyed into the sewers, so as to prevent that direct pollution of the river?—They do not come within a quarter of a mile of our place.

4960. Have you heard of what is called the earth-closet?—I have heard a description of it, but I have not seen it.

4961. Do you know upon what principle it is made?—I believe it is by using sifted earth for the refuse to fall on and to be covered over by it. I think the difficulty would be to get the quantity of sifted earth that was required.

4962. (*Chairman.*) Do you use any engine power?—Yes.

4963. What do you do with the ashes?—We burn everything up to the clinkers.

4964. You have no refuse ashes?—No.

4965. (*Professor Way.*) If you are not near to a sewer the probability is that you are near some land, and would it be impossible for you to sift the earth that might be necessary for the earth-closets requisite for 30 or 60 persons?—Not impossible, but it would be expensive.

4966. (*Chairman.*) Could not you so arrange the privies that an iron cart should receive the refuse, and then let the farmers take it away as the manufacturers do in the valley of the Aire and Calder, perhaps from 700 or 800 people?—Such an arrangement is quite possible.

4967. Would not the farmers pay for it?—I really do not know, but I am afraid they would not pay anything for it.

4968. If you were put under compulsion, and you were forbidden any longer to pass refuse into the river, would you not be obliged to do something with it?—Yes, we should be under the obligation then of asking the farmers to come and fetch it away, and therefore they would not pay anything for it.

4969. If the manufacturers in the north can get their refuse taken away into the country with profit to themselves, would there be anything unjust in saying that you should do the same thing?—Perhaps land is more valuable there, and manure perhaps is of more value than in an agricultural district like this.

The witness withdrew.

Mr. T. W. Grindle.

Mr. Thomas W. Grindle (Hertford) examined.

4970. (*Chairman.*) Do you manage the outlet works here?—Yes.

4971. How long have you managed them?—For nearly nine years, since they commenced.

4972. What weight of solid material do you get out in a week?—Not more than about 4 tons, perhaps 4 tons 10 cwt.

4973. Do you sell it?—Yes, we get 2*s.* 6*d.* a ton for a farmer's ton, about 25 cwt.

4974. Do the same farmers take it more than once?—Yes.

4975. They find that it is worth the price they give for it?—Yes; one of them has spoken for a lot after having taken it for four or five years before.

4976. Do you take it out and let it get dry?—We merely cast it out and let it drain.

4977. Does it smell in hot weather?—It does if there is any rain when the warm weather comes.

4978. Do you use lime to cause it to deposit?—Yes; lime to deposit and chloride of lime to disinfect.

4979. What weight of lime do you use in a week?—About 7 cwt. a day.

4980. How do you mix it, by hand?—It is mixed by a small waterwheel, there is a fall of about 3 feet.

4981. How much chloride of lime do you use?—About 64 lbs. such a day as this; I vary it according to what state I should fancy the sewage is in when coming down. If we have not had wet weather for a long time, I should use more, because I should know that the sewage would be in a worse state than if the sewers had been freshly cleansed out.

4982. How long have you used chloride of lime?—I should say for 3½ years.

4983. Did you begin before the cholera made its appearance?—Yes; long before that.

4984. Did you begin when complaints were made as to the foul state of the outlet?—Yes, as the people of Ware complained.

4985. You used the chloride to disinfect the sewage to a larger extent?—Yes, I found that it destroyed that nasty spongy weed that you find in a ditch, to a certain extent.

4986. What is the value of the material that you use each week for disinfecting purposes?—I should say it was nearly 1*l.* a day.

4987. What amount do you pay for wages?—About 17*l.* 10*s.* a fortnight, or 8*l.* 15*s.* a week.

4988. Do you pay 450*l.* a year for wages?—Yes.

4989. And 365*l.* for material?—I would put it at 350*l.*, it is a very little less than 1*l.* a day.

4990. Then it is about 800*l.* a year that the works cost altogether?—It is over 700*l.* a year I know.

4991. Who finds that money?—The New River Company.

4992. On the other side, what amount of income is obtained?—25*l.*, but it is not a question of taking the manure from it.

4993. It is a question of purifying, or rather of clarifying the water?—Yes.

4994. Have you had that water analysed?—Yes, several times.

4995. After it comes from the works?—Both as it enters the works and on leaving them.

4996. Have you any copy of that analysis?—It may be obtained from the engineer, Mr. Muir.

4997. Do you remember what the purport of the analysis is?—I have never seen it.

4998. Have you seen a scum rising to the surface of the river after the water from your outlet has passed in from the deodorizing works?—Yes.

4999. Does that take place more in hot weather than in cold weather?—It takes place more in hot weather, but on the purest river a scum will rise, but not that peculiar scum.

5000. Do you know anything of the sewers in the town?—I have seen connexions made with them.

5001. Have any complaints been made about the want of ventilation in them?—I have been frequently spoken to about it.

5002. Is there not a foul smell from the sewers?—There is more from the gullies than from the ventilators.

5003. It is from the gullies?—When I say the gullies, it is the grating that receives the washwater in the gutters, they are trapped.

5004. Would not that lead you to infer that the sewers require to be fully ventilated?—It is not so much from the sewers as from the cesspools or gullies.

5005. The gullies hold the sediment until it is cleared away?—No; at the time when these complaints were made it was a very dry season, there was very little or no water running along the streets, and there was a cesspool with a lot of stagnant water in it, and water will absorb any gas.

5006. The fact is, that a gully is a large cesspit to receive any sediment or deposit before it is passed into the sewer?—Yes.

5007. And the water becomes putrid?—Yes, unless it is changed; all gullies are upon the same principle, even in London. These are 16 or 18 inches, just large enough to put a scoop in. It was merely on account of the dry weather that the first complaint was made, and they did not keep a continual supply of water in those gullies.

5008. It was not gas coming back from the drain—No, there is too much water in those drains for there to be any great smell.

5009. (*Mr. Harrison.*) How are the sewers ventilated?—With an iron ventilator in the middle of the road.

5010. (*Chairman.*) Have you seen the method by which ventilators can be constructed so as to compel the gases to pass through a certain quantity of charcoal?—Yes; we have not tried that. We do not consider that we are bound to take away the smell.

5011. (*Professor Way.*) May I ask whether this is a case of divided authority?

(*The Mayor.*) The matter has been under the consideration of the corporation. The opinion of counsel has been obtained, and we are now in communication with the New River Company upon the subject.

5011*a*. (*To the witness.*) Who has charge of the drains?—The New River Company.

5012. Then the corporation have not charge of their own drains?—No.

(*The Surveyor.*) I may mention that the old drains, before the introduction of sewers by the New River Company, were made in each separate parish by the surveyor. There was no regular system about it. The fall was very little in the upper part of the town, and of course the old system was very bad. The New River Company were not bound to interfere with those old drains, but to intercept them, cut off their connexion with the river, and turn them into their sewers. In consequence of this there has never been any perfect system of drainage or sewerage, and the corporation has nothing to do with them beyond seeing that they are kept clean.

5013. You do not owe any allegiance to the corporation?—Not the slightest.

5014. You have the control of the drains?—The control of the sewers, not the drains.

5015. (*Chairman.*) When was the defect in the ventilation of the sewers first complained of?—It was first spoken about to me the year before last.

5016. That was a very hot year?—Yes, and a dry year. I may say that it was only a year before that that I had charge of the sewers.

5017. (*To the witness.*) Your sewers are ventilated in the same manner as the great majority of the metropolitan sewers by a shaft through which the gases escape in the centre of the street?—Yes.

(*Mr. Beardmore.*) Might I be allowed to explain that, when the New River Company laid down their new sewer through Hertford all the old drains had a fall to the river, and they bricked up the mouths of the sewers going to the river and made a thorough good stoppage of it, but the sewers still lie with the fall reversed; then the old gullies were also left, so that there are many things in the town which have not been altered, that the New River Company did not alter.

(*The Surveyor.*) I do not think there were any of the old drains left; they were intercepted and reversed some of them.

The witness withdrew.

Mr. William Pollard (Hertford) examined.

Mr. W. Pollard.

5018. (*Chairman.*) You wish to put in some papers, I believe?—Yes. This (*handing in the same*) is the original memorial from the corporation when they applied for 3,000*l*. to make new waterworks, and this is the counter memorial (*handing in the same*) which was agreed to and signed by a majority of the ratepayers of Hertford, and there is also the second rejoinder that we issued to the reply of the corporation.

5019. Are there any other documents that you wish to put in?—I have observed that you mentioned Mr. Ranger's visit to Hertford, and I have brought you a copy of the "Herts Guardian" (*handing in the same*), containing a report of Mr. Ranger's inquiry relative to the permission of the Lords of the Treasury to raise this money for the work to be done here. Mr. Armstrong was then acting on behalf of the ratepayers of Hertford in opposition to the corporation, but he was unable to attend at the meeting which took place when Mr. Ranger came down, and the bulk of the thing fell upon myself. That will account for Mr. Armstrong's name not being mentioned in that report, but he was acting officially for us. I have also a paper containing Dr. Taylor's report, but I have brought you a copy of it in print (*handing in the same*).

5020. Are these all you wish to put in?—Yes, the evidence is closed, and therefore I do not think I ought to take up your time, but I may perhaps say that the analysis made by Dr. Taylor resulted from some remarks that I made. You will remember that in August last the Privy Council recommended that all water should be boiled and filtered before it was used. The surveyor general to the Post Office sent a similar recommendation, and there was one also published in the Lancet. I had stated that I did not consider it advisable that the water which the public received from the new waterworks should be used without being boiled and filtered, and I believe it was in consequence of those remarks that an application was made to Dr. Taylor, and he made his analysis of the water; but it has always seemed to me that there was something very inexplicable in that report. Dr. Taylor gives a very favourable analysis. I do not say this with any idea of casting any imputation upon Dr. Taylor, but you know that the opinion of counsel sometimes varies according to the instructions that are given, and the questions that are asked. Dr. Taylor stated in his analysis that the water was pure, and I took the liberty to ask him by letter what he meant by those terms, whether he meant that the Hertford water was exceptional water, to which the recommendation sent all over the country that it should be boiled and filtered did not apply, or whether he meant that it should be filtered for making tea, or drinking cold. We have here many excellent springs of very pure water. I believe that no town is better supplied than Hertford is, and to those who drink water at their meals, it is of great consequence that we should have the best water we can get. To those who drink beer it is another consideration, because that water has been boiled. I asked Dr. Taylor with regard to what he meant by "Fit for drinking," and he said, "The words fit for drinking, "mean simply that the water is fit and proper to drink "cold. With respect to filtering, I think it proper,

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"under present circumstances, that all water for "drinking should be filtered if drunk cold." He furnished me with plans of the filters that he used in his own house, and after we have paid him 48*l.* 5*s.* for saying that this water is fit for drinking, he says that it is right and proper it should be filtered before it is drunk. I think I ought to add that we have some rather extraordinary evidence connected with the question of this water; it seems to me that the water from the river Lee is at times in a much purer state than at others. I fancy that the water that was furnished to Dr. Taylor for analysis was taken at a time when the river was in a purer state, and it is certain, from evidence which has been given voluntarily to me by tradesmen in the town [two of them being bakers], that the water at times is in an extremely offensive and disagreeable state. I inspected it at the request of a gentleman at the police office; it came, I believe, from the new works, and it was full of *animalculæ*. The inspector thought that the glass was not clean, and we took it a second time, and it was then full of animalculæ. Two days later I called at the house of Mr. Twaddle, who, a few days previously, had sent some water to the police office; some of it was drawn for me in a glass, it smelt disagreeably, and it had certainly anything but a pleasant taste.

5021. When do you consider the river Lee is in its purest condition; when it has the clearest water in it, or the muddiest?—I can hardly say, but I think when it is muddiest it is in the purer condition. I think I ought to say one word as to the commercial interests of the neighbourhood. I am always in direct communication with the principal merchants and millers of this locality, and I can assure you that they would regard with great jealousy any attempt to remove any further quantity of water from the river Lee for the purposes of the large London consuming companies. I believe their opinion is that your suggested reservoirs would be a very excellent scheme, if it could be carried out, in order to secure the flood water and bring it into the river at proper times, and not to admit any sewage water into the Lee at all if you can get rid of it by any other means. I have seen a good deal of Dr. Gilbert, the right hand man of Mr. Lawes, the manure manufacturer, and at his house I have met Mr. Campbell, who has been conducting sewage operations. Mr. Lawes and Mr. Campbell have both been conducting experiments at Rugby as to the town sewage, and I know that the opinion which Dr. Gilbert, who is Mr. Lawes' right hand man, and Mr. Campbell, have expressed is this, that you do not get rid of the poisonous matter of the sewage by the deodorizing process; that the refuse matter which is carted away by the farmers is comparatively innoxious compared with the water; and that the water which goes down from these works contains the quintessence of the poisonous matter. They seem to consider that you should prevent any water of that kind from going into the rivers from which water was afterwards to be supplied for drinking purposes. Personally I have had but little to do with Mr. Lawes, it has been principally with Dr. Gilbert, but I know their opinion is, that the water that comes from the deodorizing works is so poisonous that it ought not to be mixed with water from which towns afterwards draw their supply.

The witness withdrew.

Adjourned to Wednesday, 16th January 1867, at Ware.

Ware, Wednesday, 16th January 1867.

PRESENT:

ROBERT RAWLINSON, ESQ., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, Esq. | Professor JOHN THOMAS WAY.

WARE.

Mr. N. Cobham.

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Mr. NATHANIEL COBHAM (Ware) examined.

5022. (*Chairman.*) You are a solicitor?—I am.

5023. Are you clerk to the local board of health for the district of Ware?—Yes, and I have been since its formation in 1849.

5024. What is the population of Ware?—Nearly 6,000.

5025. Do you know what it was in 1849 when you adopted the Public Health Act?—Not exactly, but there has not been a very great increase.

5026. Is there any official report that was made in 1849?—No.

5027. How were you able to put the Act in force—was it done without a report being made?—We went through the necessary forms to enable us to put it in force, and we adopted it in 1849.

5028. Was any inspector sent down?—Yes, Mr. Ranger came down, and he reported upon the state of the town, and as to the desirability of having a board of health here.

5029. Have you a copy of that report?—No.

5030. How long have you known the town of Ware?—For 45 years.

5031. Is the town situate on the river Lee?—Yes.

5032. Is the river navigable up to Ware?—Yes, and to Hertford, which is two miles further.

5033. What is the principal business carried on in Ware?—Malting, and there are large brickfields besides, but malting is the principal trade.

5034. Is there much manure brought either up the navigation or taken down?—There is a great deal of manure brought up from London.

5035. Is that discharged on to the towing-path or banks of the canal and river?—Yes.

5036. Is there any system of sewerage in the town?—Yes, the town is under-drained from the commencement of it to the end of it.

5037. Who laid out the sewerage?—There was some sewerage before the board of health was established, and some has also been made since under the direction of the surveyor.

5038. Where do the sewers empty themselves?—We have five sewers that empty themselves into the river Lee.

5039. Are there any disinfecting or depositing tanks of any kind at the outlets?—No, none are required as far as smell is concerned.

5040. Does the sewage go directly into the waters of the Lee?—I wish to say that the sewer that Mr. John Marchant spoke of at Hertford as the main sewer is not at all the main sewer of the town—he was mistaken in what he said—there is a sewer of about 4 feet in diameter, that was made some 45 years ago for the purpose of taking down the flood waters from the town, since that time all the under-drains in that part of the town have been drained into this sewer, but the sewer itself was made entirely to carry off the flood waters. I should tell you that in the upper part of the town originally, and as long as I can remember, there was a sort of open ditch which was washed down by the water from the Lee twice a week, of course all the filth and manure of the town were washed down the street and went down just where this large sewer is that Mr. Marchant spoke of; it went down there where the sewer is now; it used to go down the surface of the street, all the flood water that came down discharged itself into an open sewer

2 or 3 feet deep. In order to get rid of that the trustees of the Cheshunt trust made this large sewer to bring down the flood water, they took it through private property; they did not adopt the plan that they had. Under a blacksmith's shop nearly opposite to where it goes down, by Mr. Gosling's, that is a covered sewer.

5041. You take down now in a covered sewer what formerly went down in a surface channel?—Yes.

5042. Are there many waterclosets constructed in Ware?—The surveyor will give you the exact number. I think there are altogether 260.

5043. Do you know what number of butchers there are in the town?—Seven or eight.

5044. Have they private slaughter-houses attached to their premises?—No, they are not attached to their premises.

5045. Whatever killing takes place is done in private slaughter-houses?—Yes.

5046. Where does the drainage from those slaughter-houses go?—They are not drained into the river at all, the refuse is taken away in carts.

5047. Are they drained into cesspools?—Yes; one is drained into the river.

5048. Is the blood always carried away?—Yes. I have said that one is drained into the river, but the blood is not drained in, the washings of course go.

5049. If there is any drainage from any of the slaughter-houses it will go the way of the other drainage?—Yes, for that one which I have mentioned, the others drain into cesspools, but they do not allow them to overflow.

5050. Is there an inspector of nuisances for the town?—Yes, he will be here to be examined.

5051. Are there any markets or fairs held in the town?—There is a market every Tuesday, and two fairs which are held in April and September.

5052. What is sold in the market that you have every week?—It is for the sale of corn and cattle.

5053. Where do the washings from the streets and the dirt caused by the cattle go?—We have not a sufficient number of cattle here to have any washings.

5054. The cattle brought to market are not numerous?—No.

5055. What is the chief trade of the district?—Malting; it is the largest malting business in the kingdom, we have returned upwards of 200,000 qrs. of malt.

5056. What value in money do that quantity represent?—I have a return here from the collector in the district, and the figures are 256,224 qrs.

5057. What would the average price be?—78*s*.

5058. Is barley grown in the district?—There is very little barley grown in proportion here, it is brought from all the surrounding counties, Norfolk, Essex, and Cambridge.

5059. Is it brought to Ware by railway partly and by the river?—The barley is chiefly brought by the railway.

5060. Does it go away as malt by the river or by the railway?—Chiefly by river—by far the greater proportion after it is made into malt—they could not take it all away by the railway.

5061. Will any practical maltsters be here to give evidence?—Yes; the information that I have obtained was from the collector.

5062. Is there any public water supply in Ware? No.

5063. How do the inhabitants obtain their water?—They get it from pumps on their own premises.

5064. What is the subsoil?—Gravel overlying chalk in all this part of the town, lower down beyond the bridge the subsoil is boggy.

5065. Do they obtain an abundant supply of water by sinking wells?—Yes.

5066. If there are only 250 waterclosets in use, I assume that by the rest of the population cesspools are used?—Yes.

5067. Are they sunk into the same gravel that you get the water from?—Yes.

5068. You have a system of wells for water supply, and cesspools or cesspits for storing the refuse?—Yes.

5069. Are those cesspits or cesspools emptied by the individuals who own them, or is that operation considered to be a part of the duty of the board?—They are emptied at the expense of the individuals.

5070. When they choose, I suppose, to give you notice?—No, it is the duty of the inspector to take care that proper notice is given to the parties when the cesspools get full.

5071. Are they served with a notice?—Yes, if they require it, and they are liable to a penalty if the cesspools are found to be full without any notice under the byelaws of the board.

5072. Are any regulations laid down as to the time when they are to be emptied, or are they emptied indiscriminately, or at any time?—No, the parties are bound to have them emptied between 12 o'clock and 4 in the morning in properly covered carts, and the sewage has to be conveyed out of the district.

5073. Has there been any complaint of a nuisance being caused during the time when those places were being emptied at night?—It is the business of the inspector to take care that there should be no cause for complaint, and that they should use ime.

5074. Have you a cesspool at your house?—No, a watercloset.

5075. Have you ever passed by at night when the cesspools were being emptied?—Yes, I have smelt them offensively, on coming home at night from a party.

5076. You would say I suppose that generally where the matter has become putrid it is offensive, and its offensiveness would be in proportion to the kind of weather when the emptying takes place?—No doubt of it.

5077. In hot or damp weather it would be more offensive than in dry weather?—Yes.

5078. As a local board have you any public debt?—Yes.

5079. For what purpose was it incurred?—We incurred a debt for paving purposes.

5080. To what extent?—1,500*l*.

5081. Have you repaid any part of that debt?—Yes, we are paying it off at the rate of 150*l*. a year and the interest; we borrowed 1,500*l*.

5082. Have you ever discussed at the board the desirability or otherwise of having a public water supply?—We have discussed that question several times.

5083. Where do the maltsters get their water?—From wells of their own.

5084. Is it pumped up by engine power?—No, it is pumped up by hand except in one instance.

5085. Is there little or no engine power used in Ware?—None; except that the New River Company have an engine.

5086. What do coals cost you for domestic purposes in Ware?—About 26*s*. a ton, sometimes less, never so low as 20*s*., I mean delivered at 26*s*.

5087. Is any part of the town or the neighbouring district liable to be flooded in times of excessive floods from rain?—We have had immense floods, but the town of late years has not been flooded.

5088. What part of the district is generally flooded?—The meadows are flooded constantly, but the town itself is not. Years ago, and until means were applied for the better getting off the water by the trustees of the Lee, I have known Amwell End to be so flooded as to be impassable.

5089. Have you heard complaints made with regard to that flooding, as to its causing disease, or fever, or making the place unhealthy?—None; I believe that Ware is an extremely healthy place, owing to the subsoil being gravel.

5090. To whom does the land which is flooded belong?—To different owners.

5091. Not to any large landed proprietors?—No.

5092. Have you any large landed proprietors in the neighbourhood?—No, not adjoining the river.

5093. There are no large landowners owning pro-

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perty in the town?—No, there are some large proprietors of land lying outside the town, but not adjoining the river.

5094. There is nothing that impedes the growth of the town?—No.

5095. By whom is the house property owned—by separate private owners?—There are a great many owners; we have no noblemen who have any control over the property, it is a great deal dispersed; the maltsters hold property of their own.

5096. Is the land generally held on leasehold or freehold tenure?—Freehold.

5097. What does land sell at in the town per square yard?—The price varies very much. When we laid out a new street, the land fetched from 50*s.* to 3*l.* for building purposes. Land is dear in the neighbourhood, from 80*l.* to 90*l.* an acre.

5098. May we take it that Ware is at the present time a thriving place?—Yes, I think so. There was more malt made in Ware last year than had ever been known to be made before. The town was very much depressed a few years ago in consequence of the failure of a bank, but since that it has recovered itself.

5099. Do you remember what number of applications have been made to the local board of health, or were made last year, for new buildings?—No.

5100. I suppose that all persons are required before hand to deposit plans and to give you notice of their intention to build houses?—Yes, they are required to deposit plans and to show what drainage is intended, and I may state that there was an instance the other day in which a London builder did not furnish any plans, and he was summoned before the magistrates and fined, but only nominally—there was no desire to press upon him because it had been evidently done without knowing what the laws of the town were.

5101. You have had considerable experience of the working of the Public Health Act, and the Local Government Act?—Yes.

5102. Have you found them of any advantage to the town?—I consider that they have been a very great advantage, the town is in a very different state now, indeed I think it would hardly be known by persons who knew what it was 20 years ago.

5103. Has there been any unpleasant interference with your affairs by the central board?—No, they have never interfered with us in any way.

5104. Have you ever had occasion to ask advice of the central board as to what it would be best to do under certain circumstances?—Never; the board here have always conducted their own affairs, quite independently.

5105. You would say then generally that in your transactions with the central board in London you have never been obstructed or improperly interfered with?—Never.

5106. Upon the whole you believe that you are better off on account of having adopted the Local Government Act?—Yes, I am quite sure that we are very much better off.

5107. What number of members do you elect on the board?—We elect three members annually; the whole board consists of nine.

5108. You have a clerk, surveyor, and inspector of nuisances?—Yes, and an officer of health.

5109. Is it unfair to ask you what the salary of the clerk is?—No, I receive 100*l.* a year, which includes all the law expenses, whatever they may be, except cash out of pocket.

5110. For that remuneration you attend the board and keep their minutes either by yourself or by one of your clerks?—Yes, I conduct all the correspondence.

5111. You transact the whole of the law business?—Yes, free of expense, except money out of pocket.

5012. What does the surveyor receive?—30*l.* a year.

5113. What do you pay the inspector of nuisances?—25*s.* a week, and he collects the rates for the board.

5114. He is both rate collector and inspector of nuisances?—Yes, for the board.

5115. What does the medical officer receive?—10*l.* a year.

5116. How often does the officer of health report to the board?—Every board day; once a fortnight.

5117. Are those reports verbal or made in writing?—In writing.

5118. If it was required, could you give us an abstract of them?—They are here to-day.

5119. Have you any suggestions to offer relative to the special purpose of our inquiry?—I may say that I do not see that it would be possible to divert the drainage of this town in any way, as the water from the maltings alone passing through our sewers in the malting season amounts to 37,000,000 of gallons, that is during six or seven months, and it all passes back into the river.

5120. What do you infer from that fact?—That I hardly know how it would be possible to take our flood water and 37,000,000 of gallons from the maltings into any place for drainage.

5121. Have you any idea what sized sewer would be required to pass off 37,000,000 of gallons in the months you have mentioned?—It is not the passing it off only, it is the stowing of it away.

5122. You are supposing that it should be dealt with and not allowed to pass into the river?—Yes.

5123. Do you know whether there is anything in that water that would make it desirable for irrigating purposes; what does it contain?—I do not know, that is rather a chemical question, but the water when it comes from the cistern is not disagreeable in itself. If it is allowed to become stagnant it vegetates, and then becomes very offensive.

6124. Is there any other difficulty that you can point out that presents itself with regard to your sewerage?—Yes, the fall through the maltings is all to the river, and I cannot conceive how you could get it away unless you made drains for the purpose.

5125. Do you see any difficulty in dealing with the sewage proper?—I see the same difficulty, because all the malting water is drained into the sewer and mixed with the sewage and the flood water.

5126. If the Legislature were to forbid you to pass foul water of any kind into the river, do you suppose that that would impose upon you a serious difficulty?—Yes, I do. I conceive that it would be one of the most unjust things that ever happened to any town. I look upon the navigation to be one of the great highways of the country, and into it this town has always drained.

5127. Are you aware what number of people are supplied from the Lee with drinking water in London?—Not at all.

5128. Will you be surprised if I tell you that something like one million of persons are dependent upon the river Lee for their supply of water for domestic purposes?—No, I should not be surprised at it at all.

5129. If health is the first requisite in the world, and if, to preserve it, it is necessary to supply the people with wholesome and pure water, is there anything you can put in the opposite scale when 1,000,000 of persons are concerned?—With regard to the schemes which have been suggested for the purpose of taking pure water to London, I do not think, as far as the river is concerned, that you can have a supply of pure water in London from any open river like the Lee.

5130. You probably think that it would be better to bring in, as has been proposed, pure water from the lakes of Cumberland, or elsewhere, and leave the Lee to be used for the purposes of navigation?—Yes, decidedly; because if you shut up the river Lee, and this town is not to have the use of it for navigation, you might as well shut up the town altogether; you would seriously injure or do away with the malting trade altogether.

5131. You are of opinion that for the interests, not only of this town, but of the district, you must preserve the river Lee as a navigation?—No doubt of it.

5132. According to your views you are to make use of the river Lee as the medium of draining the country?—No, I do not go quite so far as to say that you

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are to allow all kinds of drainage from manufactories, or to let all kinds of poisonous matter pass into the stream; but as to any drainage that passes as it does from this town into the Lee, that is, malting drainage, and the drainage of the town going in as it does at so many different places, I say that there is no smell from it at any part of the town. As I stated before, the main drain, that was so spoken of by Mr. Marchant, is not the main drain, and as the drainage passes off there is no smell from it whatever.

5133. Looking at the question in a common sense point of view, if you had only the soluble portions of the sewage from one watercloset, whether it smelt or not, to deal with, do you think you could divest your imagination of the thought that it was poisonous if it was to be drunk?—I do not believe that when once the poison is in you can get it out.

5134. If poisonous matter passes into the river Lee and the water is afterwards to be drunk, do you think that ought to be so?—I say that I think it ought not to be so.

5135. That is to say, you would prevent people from drinking the water of the Lee?—Yes.

5136. You would not attempt to purify it?—I would not have the river Lee made a cesspool of, but I think that all matters that did not cause a nuisance ought to go in. I may mention that the New River Company, when they applied to Parliament for a bill some years ago, had a clause inserted in the bill to prevent the sewage of Ware going into the Lee. The board of health instructed me to oppose that clause, and I think I attended the committee of the House of Commons for 23 days for that purpose. The committee struck out that clause, and introduced a clause preserving the right of the board of health to drain into the Lee; that was in 1851.

5137. Have you seen the new Act which has been obtained by the Conservators of the river Thames?—I have not read it.

5138. I should recommend you to look at it carefully and see what Parliament has done in that case?—I will do so. The great thing that we have to contend against is the sewage from Hertford, which creates the greatest possible nuisance in this place; their sewage is brought down all together, while ours passes in at a variety of places. The board were advised with reference to the Hertford sewage to take the opinion of counsel, and the opinion of counsel was that the New River Company ought to be indicted.

5139. (*Mr. Harrison.*) They take steps at Hertford to disinfect their sewage do they not?—Yes.

5140. Notwithstanding that, you say that a nuisance is caused to the inhabitants of Ware by the sewage of Hertford?—Yes, and so much so that people cannot sit in their own summer-houses or be on the water at certain times. I have communicated with the trustees of the navigation upon this subject several times.

5141. Is there a deposit caused in the river?—The sewage creates a sort of fungus on the top of the water. The drainage of Hertford comes into a piece of still water, and when the barges pass through a lock the water that comes down is most offensive.

5142. How far below Hertford is the first lock?—At a distance of about a quarter of a mile.

5143. What fall is there to that lock?—About 8 feet.

5144. How far is it from that lock to the next?—Two miles along the watercourse.

5145. How much fall is there between the two?—I am told that there is a fall of 11 feet in the two miles. The Hertford sewage comes down what is called the Manifold ditch into a still piece of water; it passes only through one lock before it comes here.

5146. Is there any land on the side of the Lee that you think might be obtained on to which the sewage might be passed for irrigating purposes?—The New River Company had a clause introduced into their bill by which they proposed then to take the Hertford sewage right away below Ware along the river Lee, but the New River Company were not to carry that part of the bill out unless they liked, but they bought land of a gentleman who is present, for the purpose of taking the sewage of Hertford below the town of Ware.

5147. Is there any land below Ware upon which the sewage of Hertford might be applied in the way of irrigation?—Yes, no doubt there is.

5148. Do you think you could obtain that land without any difficulty?—I do not think any land could be obtained anywhere near here without difficulty.

5149. Are you aware that sewage when applied to land in that way is found to be most fertilizing and profitable?—I think it is so, but not so much after it has been deodorized; when it is taken directly on to the land I have no doubt it is as you say, but if it is first deodorized my opinion is that the virtue is taken out of it.

5150. In this case you appear to have a fall of 11 feet within a distance of two miles of the town, that is abundant fall to enable you to apply the sewage of Ware to the land?—The fall of 11 feet is above Ware, and I believe there is about the same fall between Ware and Stansfield.

5151. There is abundance of fall from Ware downwards, is there not, to enable you to apply the sewage of the town to the land without any pumping?—No doubt of it.

5152. You say that you know it is profitable, and if the sewage could be applied to land without any pumping there would seem to be no hardship in calling upon the inhabitants of Ware to apply it to the land?—I do not know where you are to go; as to the sewage from the maltings, according to the fall that there is now, you could not get that back into the town.

5153. (*Professor Way.*) I think you stated that it would not do to shut up the navigation?—The question has been asked, I think.

5154. Do you think it would be impossible, while the navigation was preserved, to improve the condition of the water?—No doubt the purity of the water would be improved if you were to shut out the drainage.

5155. Do you know of any reason why that should not be done in Ware as in other towns?—It would be attended with enormous expense to the town unless it were done at the expense of Government or at the expense of the large water companies.

5156. What should you consider an enormous expense?—I hardly know, but I hear that it would be an enormous expense to the town.

5157. You have stated that 37,000,000 of gallons of water were discharged from the maltings in six or seven months, which is something like 200,000 gallons a day?—I mentioned that quantity as being something like what you would have to deal with if you had to stow it away in any place; I mean a place to receive the sewage of the town.

5158. (*Chairman.*) I wish you to dismiss from your mind the idea of stowing away; this Commission will never recommend the stowing away of that which would grow more corrupt every day?—I am glad to hear you say so.

5159. (*Professor Way.*) There is that certain quantity to be dealt with every day, 200,000 gallons, which are only one-fifth of a million, and 1,000,000 gallons of water are dealt with every day at Croydon at this moment without any trouble?—Then you must take the large sewer that comes down the town, which is a 4-feet sewer, and that is full of water in flood times, full to the brim.

5160. (*Chairman.*) Does that sewer also convey the town sewage?—Yes, that is the one Mr. Marchant spoke about as being the main sewer of the town; it takes away the flood water and a portion of the sewage of the town only.

5161. (*Mr. Harrison.*) Does the water from the maltings pass into a part of the river that is stagnant?—It passes into a variety of places.

5162. Is the navigation stagnant?—No part of it.

5163. Is it always on the move?—Yes; Ware mill

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is situated above the town, and the water in that part of the river is always passing downwards.

5164. (*Professor Way.*) There is no reason, is there, why the same thing should not be done here that is found to be advantageous when done in other towns?—No, all things being equal.

5165. Mr. Harrison has elicited from you that there is a fall by which the sewage of the town might be passed away?—No doubt there is.

5166. You have also stated that there is a larger malting trade carried on in this town than in any other town in the kingdom?—Yes.

5167. I suppose you know that in the act of converting barley into malt a certain quantity of the substance of the barley is taken away in the water in which it is steeped?—Yes.

5168. Do you think that that is likely to be injurious to land?—No.

5169. Does not it follow that the sewage of this town, plus the water from the maltings, would be better than ordinary sewage?—Yes.

5170. Does not that lead to this, that there could be no serious difficulty in dealing with the sewage of this town and possibly a great advantage?—I think there is a serious difficulty in getting rid of the drainage from the maltings and from the town.

5171. (*Chairman.*) Are you of opinion that the water from the maltings would be a benefit to the land rather than an injury if applied economically?—Yes, I think it would be.

5172. Would it not take back to the land that which would be beneficial to it?—Yes.

5173. Are there any water meadows in this neighbourhood where irrigation is practised?—None that I know of.

5174. Did you ever see waters meadows so treated?—No.

5175. You know, I presume, that there are places where irrigation is carried on by spring water?—I do not know that.

5176. I suppose you would think, that if something was put into that water to add value to it as manure, it would be more advantageous to use it?—No doubt of it.

5177. If town sewage is passed into a certain volume of water, and the refuse from the steeping of malt, which contains solid ingredients that would be beneficial to land, is also passed in, I suppose you would consider it so much better than spring water?—No doubt of it.

5178. And the only other question to be considered would be the cost of the apparatus, the labour required for putting it on the land, and management?—Yes, no doubt of it.

5179. You have never witnessed the irrigation which is carried on at Croydon, Worthing, and Norwood?—I have not.

5180. Have you never read anything about it?—Very little.

5181. Do you know what weight of hay is usually taken off a rich meadow?—I took five loads off $2\frac{1}{2}$ acres the year before last.

5182. What might that represent in weight?—It was above 36 cwt. per acre; but it was an exceedingly good crop that year, for there was hardly any grown.

5183. Are you aware that your meadow might be made to yield 10 times that weight?—I should be very glad if it could; I think it might be made to produce a great deal more by passing sewage matter on to it.

5184. (*Professor Way.*) You have no reason to believe that your town is worse situated than any other town you know of for the disposing of the sewage as has been suggested on the land?—No, if there is sufficient fall, certainly not.

The witness withdrew.

H. Butcher, Esq.

HENRY BUTCHER, Esq., (Licentiate of the Royal College of Physicians, Edinburgh,) examined.

5185. (*Chairman.*) You are medical officer of Ware?—I am.

5186. How long have you known the town of Ware?—Nearly 30 years.

5187. How long have you practised as a surgeon?—Altogether since 1828.

5188. We may assume, I suppose, that you have had very considerable experience in this district?—Yes.

5189. Are there any special types of disease connected with the district that you can name to us?—No, I think not.

5190. Do the inhabitants never suffer from ague?—Never.

5191. Or from any low type of fever of any kind?—Very seldom; not as a rule.

5192. Do the people suffer from gastric fever at all?—Very seldom.

5193. Do you meet with typhoid fever?—Hardly ever.

5194. Or typhus fever?—Yes, at times.

5195. Have you ever had cholera here?—Yes, once since I have been here.

5196. In what parts of the town have you had to to treat cases of typhus, in what class of houses, and what class of people?—The worst cases of typhoid fever have occurred up at Musley in the new cottages that have been built there. I have had one serious case lately to treat, but that may be said to have been brought from London. The patient whom I was called in to attend had been to London to visit her father; I will with your permission read an extract from the entries contained in this book; this is a report of mine, "I beg to call the attention of the board "to the extremely dirty condition of some cottages in "Musley, particularly to one which I have already "named to the inspector of nuisances. I have met "with none so filthy for a long time, it consists of "three small sleeping rooms, and up to within a few "days they have been occupied by the lodger, his "wife and three children; the tenant of the house, "his wife and two children. The wife of the lodger "is dangerously ill with typhus fever, caught proba- "bly whilst on a visit to her father in London who "died from fever about five weeks ago; a sister died "from the same cause about three weeks before, and "the mother on Friday last. I called the attention of "the relieving officer to the case on Tuesday last; "he refused to interfere, and up to this evening has "made no personal inspection, and I shall not be at "all surprised if the fever becomes of serious conse- "quence to the immediate neighbourhood."

5197. After you had made that report to the local board, did they cause the house to be purified?—I believe it has not been done yet. This was on the 10th of December, and there has been fever ever since in that house.

5198. Do not you think that in that case the board would only do their duty by taking possession, legally or illegally of that house for a short time, for the purpose of cleansing and purifying it?—Yes, and I called the attention of the relieving officer to the matter on Tuesday last being also a guardian of the union, but as I said before he refused to interfere, and up to the evening of the day when I made the report had made no personal inspection. I should explain that the relieving officer refused to interfere because the husband was said to be earning 5*s.* a day; he did not even go to inspect the house, and when the case came before the guardians, before whom I brought it a day or two afterwards, they decided that he ought to have gone to inspect the case and have given relief. If the party had been in a condition to have paid afterwards it ought to have been done in the way of a loan.

5199. Might you not compare the existence of fever in one small spot to a large farm building which had caught fire and had just begun slowly to burn, and which a few buckets of water would at once extinguish, whereas if no attempt was made to arrest the progress of the fire the whole place might be burned down?—Yes.

5200. And so if that particular house had been dealt with in the case you have mentioned, the spread of typhoid fever might have been prevented throughout the district?—I believe that a great deal might have been done, and that was my object in bringing the matter before both boards as I did.

(*Mr. Cobham.*) May I be allowed to say with respect to that report of Mr. Butcher's, that the inspector of nuisances received orders to visit the house immediately, to use disinfectants, and to see that the parties did everything that was required to be done. Disinfecting fluid was entirely at his service. I should, perhaps, add that this happened at a time when the board had adjourned for a month in consequence of the Christmas holidays.

(*Witness.*) The disease has not yet disappeared from that house, and the occupier, a woman, is still suffering.

5201. (*Professor Way.*) How long has that woman been ill?—I think I was called in about the 7th or 8th of December.

5202. And fever exists there now?—Yes.

5203. (*Mr. Harrison.*) Were you called in as medical officer of the board of health?—No, I was called in as a private practitioner.

5204. Were the parties in distress and in want of relief?—Yes, so far that there was not proper nursing provided; the woman was occupying a room with three children, and although the man was said to be earning 5*s.* or 7*s.* a day when employed, he had been ill himself some time ago with diarrhœa; some months back after coming from London at the time the cholera was prevalent.

5205. Was he at the time receiving 5*s.* a day?—Yes, and that was the relieving officer's excuse for not going. (*The witness subsequently informed the Commissioners that the illness of the above-mentioned female patient had terminated fatally.*)

5206. (*Chairman.*) Have you at any time had occasion to suspect the purity of the water that the people were drinking in places where fever and disease of any kind has been prevailing?—Yes, I have; there were three or four cases which I noticed in my reports, and in one place the water used to be very pure in one of the wells, but there has been a privy erected near it and that has polluted the water, so that it cannot be used for domestic purposes.

5207. (*Mr. Cobham through the Chairman.*) Are you aware that that well was stopped up and a new well sunk after you made your report?—Yes; I believe it has been done since.

5208. (*Chairman.*) Have you found in your experience that the use of impure water produces disease in this town?—No, I think the case I have mentioned is quite an exceptional one. The water in the wells of Ware is very good indeed. My attention has been called to the river Lee occasionally, and I have reported upon it. On the 12th of December 1864, I reported in these terms, "Last week on crossing "Ware bridge I observed the river Lee covered "with a black oily scum, which on close examination "I found was in a state of fermentation, and giving "out bubbles innumerable of gas. A large quantity "of seething and putrid mud was deposited by the "edge of the river. Whence it came I could not "satisfactorily ascertain, for on proceeding with the "local inspector to the outlet of the Hertford drain-"age all was clear and limpid." I was told by the relieving officer that the stench was very great indeed. "Still the matter, which I have no doubt, on analysis, "would be found to be of a poisonous character, might "and did most probably float from thence, that part of "the river having had time to clear itself before we "visited it." I thought, as the water there comes, as it were, upon a dead level, that it had remained there until it got agitated by barges going backwards and forwards, and that that in a great measure caused the stench. Opposite to this place there are houses, and the gentlemen occupying them have summer-houses, which they used to occupy very much. One gentleman made use of his summer-house as a study, others used to take their meals in their summer-houses, particularly their tea, but all of them, I have understood, have been obliged to give up this practice on account of the stench. I have further been told that gudgeon cannot now be found, that they have quite disappeared from that part of the river. That is all I have to say as to the condition of the drainage.

5209. You are a guardian of the poor?—Yes.

5210. How long have you acted as guardian?—I should think 15 or 16 years.

5211. Can you put in a tabulated return of the rates of mortality compared with the population?—I have gone through the reports for the last two years made by the sub-registrar of the deaths, and I find that the deaths between January 1865 and January 1867 were 231, taking the population of Ware—the population of St. Mary's being 3,400 in 1858 and of Christchurch 1,200—but the register contains also those who have died in the neighbouring parish of Thundridge. I might point to the lamentable amount of deaths among the children under two years of age, no fewer than 63 out of 231; there were 15 deaths above the age of two and under 21, 52 above 21 and under 60, 101 above 60 and up to 100; the average age of these put together is 73 and 4 months, so that Ware does not appear to be a very unhealthy town.

5212. Are the children of the town employed in any kind of occupation?—Not any.

5213. (*Professor Way.*) Are any young children brought into the town to be nursed?—No; I find that the diseases are principally catarrh and of a bronchial and rheumatic character. There is some diarrhœa in the autumn, but not excessive, and fever is generally of an endemic character; it appears in Musley and also at a place in Amwell End, where there are a number of new houses, and I never could understand why it was not included within the jurisdiction of the board of health; it is a small place which is just left out.

5214. (*Chairman.*) Judging from your past experience, do you think that if people could be induced to be cleanly in their persons, to be temperate in their lives, and could protect themselves from cold and wet when out of doors, and their dwellings were properly ventilated, you would have very little fever?—I think we should have less fever than we have; still, I have never known any real epidemic here. Scarlet fever one year was very bad, and also cholera once, but it was not so bad as it was elsewhere.

5215. When were you troubled with cholera?—I think 10 or 12 years ago.

5216. Was it in 1849 or 1850?—I believe it was about that time.

5217. Are there any common lodging-houses in the town?—Yes.

5218. Are they regulated under the Common Lodging Houses Act?—I believe so; they are visited by the inspector of nuisances.

5219. What is their condition at the present time compared with what it was before the Common Lodging Houses Act was passed?—The houses are very much cleaner; the worst one was pulled down and a very excellent house was built on its site; it is not much occupied.

5220. There has been great improvement in that respect?—Yes.

5221. Has there been in consequence a diminution of sickness?—I think there has been a general improvement in the town; we have never had anything very serious, only a few isolated cases of fever. The town has certainly been improved since the Local Government Act came into operation; the pavement of the town is better, but still the surface drainage is not what it ought to be. In Amwell End in some of the courts I have understood that the fall is not sufficient to do what is necessary. I have reported frequently upon the state of the drainage, and that has been generally the answer I have received, that the fall is not sufficient.

5222. Have you ever been called in to attend poor persons in fever-stricken and overcrowded places, at night, for instance?—Yes; in the course of my prac-

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tice I have been called up at night to go and visit them, but I do not know anything special about it.

5223. What kind of atmosphere have you generally found in those dwellings?—Very close indeed. I remember some years ago in a place called Caroline Court, which is now much improved, I had some severe cases to treat, but they were quite endemic cases; they were confined to that spot.

5224. (*Mr. Harrison.*) Can you call to mind any other cases, besides the one you have mentioned, of the water being polluted?—I cannot call to mind any others just at this moment, but there were one or two pumps, I believe, which were not situated very conveniently for the traffic, and which were closed; but the people finding it inconvenient to have them closed, I believe the board of health had them reopened.

5225. Knowing of these cases, and knowing also that the town of Ware is situated upon a substratum of gravel with a number of cesspools in the town, do you not think that the water is liable to be contaminated in the way you have mentioned?—I do not think it is.

5226. Why not?—Because I think that the pump which I have alluded to got contaminated from a privy that had been erected. I have never heard of any other pump or well being rendered offensive by any drainage.

5227. Have you had the water analysed?—No, I have not. With regard to the Hertford drainage I may state that nothing can look better; it is most inviting in appearance.

5228. May not that be the case in your town as well?—I have never heard any complaints made; on the contrary, everybody has praised the water and thought it most beautiful.

5229. (*Professor Way.*) You have been asked generally whether you have as a matter of fact traced any connexion between bad water and disease, and you said, "No"?—Yes, I say that personally I have not.

5230. Do you not believe that that is possible?—Yes; but I have not in my experience found any disease arise from bad water in this town; that is to say, I could not trace it.

5231. Do you believe or not that bad water will produce disease?—I believe it will.

5232. (*Chairman.*) Do you believe also that you may have bright sparkling water that shall not be wholesome?—Yes, I believe it is so; that it may contain any amount of poison, and yet be bright to look at; there may be oxalic acid in it.

5233. Would you be surprised to learn that into the river Lee there are tons of oxalic acid poured every year?—I was not aware of that.

5234. At Luton there is a population of 20,000; and in bleaching the straw plait and dyeing it they use oxalic acid, and tons of it in the course of a year pass into the Lee?—I have understood that some went in. We might also say that the surface drainage here would tend to pollute the river Lee, because there are barge loads of manure that are brought in and put upon the soil, and of course the first shower of rain may wash that into the river.

5235. Would not that tend to pollute it?—Yes, and it does.

5236. You probably know, from your own experience, that out of 1,000 people there may be perhaps only one who is affected by a particular medicine in a particular way?—Yes.

5237. So that an infinitesimal dose of that medicine will affect that person?—Yes.

5238. And so with well poisoning, there may be a great number of people with robust constitutions who will not be affected by it?—Yes.

5239. Have you anything further to add?—No.

The witness withdrew.

Mr. G. Hitch.

Mr. GEORGE HITCH (Ware) examined.

5240. (*Chairman.*) You are surveyor to the local board?—Yes.

5241. How long have you held that appointment?—Nine years.

5242. Do you do anything else but attend to the business of the board as surveyor?—Yes.

5243. What other occupation do you follow?—I am a barge builder.

5244. You are a kind of honorary surveyor to the local board, for which you receive 30*l.* a year?—Yes.

5245. What duties do they expect to be performed by you?—I superintend all the drainage, and I have to examine all the plans that are laid before the board.

5246. For new buildings?—Yes.

5247. You examine them to see whether the parties comply with the requirements of the Act or not?—Yes.

5248. Do the board meet fortnightly?—Yes.

5249. Have you devised and carried out any sewers yourself in the town?—I have carried out some of the branches, but not the mains.

5250. If persons wish to drain their houses into the sewers, are they obliged to give notice to the board, and deposit a plan of the proposed drains?—Yes.

5251. Do you see the connexion made?—Yes, I do, or I employ a man to do it; the board expect me to do it.

5252. Do you think that the sewerage and drainage of this town are at all as complete as they ought to be?—Not in all parts.

5253. Whereabouts are the sewers discharged; have you any plan?—I have no plan.

5254. How many outlets are there?—Five altogether; four into the navigation, and one into the old river Lee.

5255. Four of them pass their contents into the navigation, and one into the old river?—Yes.

5256. Do you know how many waterclosets there are in the town?—220.

5257. In what class of houses are they principally to be found?—Principally in the best houses.

5258. Are there any waterclosets in any of the cottages?—In some instances, but they are not supplied with water, they have pans.

5259. They cleanse them by throwing down buckets of water I suppose?—Yes, there are 60 of those out of the 220.

5260. In your experience how have you found them to answer?—They answer very well if they are properly attended to.

5261. Do you consider that they are an improvement upon the cesspit?—Yes.

5262. Is it your duty to examine and report as to the position of a cesspit or cesspool and well when a new house is about to be built?—Not as to the position of the well.

5263. Take any private house that you know, and suppose that you have within the area of this room a well in one place and a cesspool in another, how far apart would they be?—I have allowed them to put a cesspit within 30 feet of the well.

5264. Are the cesspits absorbent; do they drain away or filter away the water?—No, all the new ones have been cemented and made tight.

5265. Do you think the old ones are tight?—I do not know.

5266. Have any complaints been made to you that the water of a well has after some time become disagreeable?—Yes, in one or two cases.

5267. What do you suppose the complaint has arisen from?—In the case that Mr. Butcher referred to, it arose from a privy that had been erected some years ago close to the well.

5268. The privy was contaminating the well?—Yes, I expect so.

5269. When these watertight cesspits are made in new houses, do you make overflows to take the surplus water away into the drains?—No.

5270. Then when they get full, what do you do with the contents?—They are emptied, and the contents are taken away in a cart provided by the board of health.

5271. When they are being emptied, is there much foul smell?—I do not know, I have nothing to do with them then.

5272. Are your sewers ventilated upon any principle?—Not at all.

5273. Do you think that that is a state of things that ought to continue?—No; I think that they ought to be ventilated, but that has never been done; I have never heard any complaints about it.

5274. Do you know that there is occasionally fever in the town?—Yes.

5275. Do you know whether fever has occurred in the houses that are drained, or in the houses that are not drained?—The special case that has been brought before your notice by Mr. Butcher was in a house that has no drainage at all.

5276. Have you known a fever to occur in houses where there were drains?—I cannot call to mind any cases at this moment.

5277. (*Mr. Harrison.*) Do you remember when the main drains in the town were constructed?—No.

5278. Do you think that much spring water gets into the drains?—Yes, in the lower parts of the town.

5279. You think they discharge a good deal into them besides what passes in from the houses?—Yes.

5280. Are most of the back premises and cottages connected with the drains?—Yes, most of them.

5281. All the slops I suppose pass into the drains?—Yes, all that goes in. There is a part of the town called Musley where there have been some new houses built; there are at least 10 or 12 houses which are not drained at all.

5282. What becomes of the slops from those houses?—They are thrown out on to the surface.

5283. (*Chairman.*) Do you know that your Act gives you power to give those parties notice and to compel them to drain, or you may drain for them if you have a sewer within 100 feet of the houses?—Yes.

(*Mr. Cobham.*) I may mention that the board once served notices upon all the owners in that part of the town to make a drain to join the other drains, but it was not carried out I believe on account of poverty.

5284. (*Mr Harrison to the witness.*) You are, I understand, a barge builder on the navigation?—Yes.

5285. Do you find that any nuisance arises from the river?—Never; and I live in the lower part of the town.

5286. Below the mill?—Yes; my yard adjoins the tumbling bay as it is called, and I never smell anything.

5287. (*Mr. Cobham through the Chairman.*) Have you ever known any nuisance arise from the sewer since you trapped it?—Not the least.

5288. (*Mr. Harrison to the witness.*) Have you ever had your attention drawn to the state of the river where the sewage of Hertford comes into it?—Yes, I have several times, and I cannot say that I have experienced a nuisance from it. There is a lot of scum that arises which I have noticed at different times, and that is very offensive.

5289. Have you observed any similar notice in the river at the points where the sewage of Ware is discharged into it?—I have never noticed it.

5290. (*Professor Way.*) Do you think the quantity of the subsoil water which flows through the gravel and gets into the drains is very large?—Yes, it is in places; there is a great quantity in our sewer.

5291. In fact that sewer acts as a subsoil drain?—Yes it does, as far as it goes.

5292. If that is so, I suppose, so far as one can judge, such a quantity of water would alter the appearance of the sewage and filth?—I think it would.

5293. It does not prove that the sewage does not pass down because the water is comparative bright and clear?—No.

5294. Is it the case generally throughout the district that there is a large quantity of subsoil water which passes underneath the houses?—It is so in the sewers in the lower part of the town, but not in the upper part of the town.

5295. With regard to the cesspools, do you think they drain away rapidly?—Most of the new ones are cemented and made watertight.

5296. Do you mean that the water neither gets in nor gets out?—No, it gets in, but it is taken out by the night carts; as to any of the old ones, I do not know how it is.

5297. How often are they emptied?—That is according to the size of them. I do not know about that; they never apply to me; they apply to the inspector of nuisances.

5298. Do they often require to be emptied, or do the contents drain away into the gravel?—That I cannot say, but I suppose on the average they would require to be emptied once or twice a year.

5299. What was the object of cementing some of them?—To prevent anything from the soil draining through.

5300. I suppose it is understood that the connexion of a well with a cesspit is not a desirable thing?—Yes.

5301. And yet you say there are many cases in the town where wells and cesspits are near together, and the cesspits are not cemented?—I have no doubt that many of the old ones are not cemented.

5302. (*Mr. Harrison.*) You have stated that the sewers in the lower part of the town take in a large quantity of spring water, but that those in the upper part take none?—I did not say a large quantity, but there is always a slight drainage.

5303. Are you ever called upon to clean out the sewers in the upper parts of the town?—Never.

5304. In opening the ground to make connexions have you ever found any difficulty in those parts of the sewers?—No, they are all clean, and I attribute that principally to the quantity of cistern water that runs through them from the maltings.

5305. (*Chairman.*) The river Lee flows through Ware?—Yes.

5306. Is the town built upon both banks of the of the river?—No, only on one side; the other side of the town is Amwell End.

5307. Are there any houses or other properties situate on the margin of the river?—Only the malting trade premises, besides Ware mill.

5308. Are there any privies on the banks of the river?—Yes.

5309. Does the refuse fall direct into the river?—Yes, in some instances it does; in a few of them.

5310. In how many instances do you think?—I should say from 12 to 15.

5311. Can you name the places where they are, or upon whose property they are?—There is one on what is called the back ditch belonging to Mr. Wilkins, and there is one belonging to Mr. Lawrence.

5312. Do you think there would be any difficulty in altering the arrangement so as to prevent the refuse going into the river?—Only by making a cesspool, or by draining those places into a sewer.

5313. Have you not power to give the proprietors notice to prevent that drainage passing direct into the river?—I do not know whether we have.

5314. Is there any portion of the town where the streets are paved?—Yes, the main street is all paved.

5315. What is it paved with; sets or boulders?—Berk Hill paving.

5316. What does that cost per square yard?—We get it down at about 9*d.* a square foot, but the greater part of it was done by contract; what I have done since cost about 8*d.* or 9*d.* or 10*d.* a foot.

5317. Was that the actual cost of the stone?—Yes.

5318. What does it cost to lay it down?—The board keep a man constantly employed to do their works, and he does it for them.

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5319. What does it cost per square yard to lay it down?—About threepence.

5320. Are the footpaths flagged?—Yes, I mean them.

5321. I was speaking just now of the cart road?—There is no cart road that is paved.

5322. That is all macadamized is it?—Yes.

5323. What do you make it with—flint?—In the main street it is all granite.

5324. Where do you get the granite from?—From London.

5325. At how much a ton?—I cannot say exactly, perhaps 15*s.*

5326. Do you know how many square yards of road a ton will make?—No, I have nothing to do with the roads.

5327. What do bricks cost per 1,000 here?—About 35*s.*, at this time they are rather more, they are 1*s.* more now per 1,000.

5328. Are they dearer now than they used to be 20 years ago?—Yes.

5329. Do you think that bricks are cheaper because the duty has been taken off?—No, I know that we pay quite as much.

The witness withdrew.

Mr. T. Garratt.

Mr. Thomas Garratt further examined.

5330. (*Chairman.*) You were examined at Bishop Stortford, and you live at Hunsdon Mills?—Yes.

5331. I understand you wish to make some corrections in your former evidence?—Yes.

5332. Upon what points do you wish now to speak?—The evidence that I gave before was upon the pollution of the Stort, but I was asked whether I had any evidence to give upon the sources of the Lee and the Mimram. I described to you then the state of the Stort, and the evidence that I omitted to give then was that which I will now supply, viz., that a great deal of sheep washing is carried on in the spring of the year, and from that cause I have known the fish to die.

5333. In which river, or at what point is this sheep washing carried on?—I think there is scarcely a single place on any stream near Hertford where sheep washing is not carried on; it is carried on at nearly every point.

5334. In what months does the sheep washing take place?—In May and June.

5335. When the sheep are washed in the streams is there something that comes from the wool that is poisonous to the fish?—Yes, on the river Mimram some years ago there used to be at a place called Kimpton Mill, about 7,000 sheep washed, and in one year we had a great many trout in the river, and I can remember that after the washing there were 13 or 14 trout picked up dead. I believe nearly every farmer dips his sheep in the autumn, and in doing that, for every score of sheep it is necessary to use from 4 lbs. to 6 lbs. of dippings with a great deal of brimstone and arsenic.

5336. What is the object of the dipping, what does it do for the wool?—It kills the ticks and poisons the insects. The sheep get lousy in the summer time, and the dipping kills the fly, and prevents the scab, or the maggot; then that is retained in the wool until the spring comes when the sheep are washed before shearing; it improves the growth of the wool but it is certainly then washed off. On the Stort I washed some sheep this last spring, and after that I saw the gudgeons and small fish quite sickly on the top of the water.

5337. Are there any other points that you wish to speak to?—I told you I think that at Welwyn and Whitwell there is scarcely a house where the privies and waterclosets are not drained into the river.

5338. And the sewage goes down with the water?—Yes, the Mimram is the clearest stream that runs into London if it is not polluted. I have lived upon it for 20 years, and I never yet saw it overflow its banks; it rises through veins of chalk, and it would be one of the finest trout streams were it not for the pollution from a tan yard at Whitwell that used to run in; the lime used to kill some of the trout.

5339. What number of barges pass Hunsdon Mill down the Stort, or what number did pass during the years 1862, 1863, 1864 and 1865?—I receive a toll for every barge that goes down the river Stort. The proprietors of the barges send me a toll of 1*s.* for the journey of every barge, less 2*d.* for collection, which makes it 10*d.* In 1862 there were 720; in 1863, 732; in 1864, 745; and in 1865, 757 that went the journey up and down. I believe there were about 10 or 12 more that came up from the Lee as far as Roydon, or Roydon station.

5340. What is the size of the lock above your mill?—It is 92 ft. long, the width at the bottom is 14 ft. 6, at the top 36 feet. I have always complained that there was a great waste of water on the river from there being no Commissioners; every dispute between the millers and the proprietors should be settled by the Commissioners, but some years ago the Commissioners died; they allowed them to die off, and no fresh ones were appointed, it was under the 32nd Clause of their Act that the disputes between the millers and the proprietors were to be settled by the Commissioners. I have complained several times to the Stort proprietors about the great waste of the water, for I consider that each lock takes much more water than it ought to do.

5341. Have the locks any side walls?—The Roydon Mill has, but the Hunsdon Mill is made wide at the top and tapering down. Under the Act of Parliament they are bound to compensate me for the full loss of my water. I mean through the Commissioners, but as they have allowed the Commissioners to die off, I have no resource, no claim, unless they appoint Commissioners. It was stated by one of the witnesses at Bishop Stortford that the millers were under a penalty of 20*s.* for refusing to comply with the navigation orders, but it is 40*s.* through the Commissioners as provided in the 6th George 3rd, Chapter 78, Clause 8. This is a private navigation and has nothing to do with the Lee.

5342. Have you anything further to state?—No.

The witness withdrew.

W. Parker, Esq.

William Parker, Esq. (Ware), examined.

5343. (*Chairman.*) Where do you reside?—At Ware Park in this parish.

5344. How long have you known Ware?—For 35 years; I have lived here for 25 years.

5345. Do you know the condition of the river Lee?—Yes.

5346. Are you officially interested in the Lee?—Yes, I am a trustee.

5347. Do you attend the meetings of the Trust?—Yes.

5348. The river Lee I assume is managed principally as a navigable river by the trustees?—Exactly so.

5349. Is it any part of your duty to preserve the water of the Lee pure for domestic purposes in London?—In a very recent Act of Parliament there is a clause to prevent draining into the Lee, but it has been found very difficult to carry out that power.

5350. Do you know that drainage is still passed into the river?—Yes.

5351. Is it not desirable that that should be miti-

gated or prevented?—For the navigation I do not think that the drainage into it is objectionable.

5352. Do the trustees receive any beneficial income for the water supplied from the Lee to the metropolis?—The water of the Lee in its present state has been sold to the New River Company and to the East London Waterworks Company.

5353. Is there a sort of rental paid for it?—Yes, for certain given quantities.

5354. Taking that as a precedent, and assuming that it is necessary further to purify that water for consumption in the metropolis, might there be an equitable arrangement come to, if Parliament empowered the trustees to effect certain improvements, the expense of which the water companies of London were willing to meet, and would the trustees undertake to discharge the necessary duties?—I have no doubt of it.

5355. You are an unpaid body of trustees?—Yes.

5356. Your servants are paid?—Yes, and that is all; it is very much like the old system of turnpike roads, we are an unpaid body, and we meet in order to see that the navigation is kept in repair.

5357. (*Mr. Harrison.*) I presume you look upon the navigation as a benefit to the whole country?—Yes.

5358. (*Chairman.*) Do you consider that it confers a money value upon the estates which lie adjacent to it in the different districts through which it passes?—Yes.

5359. And that it confers a benefit upon the property situate in this town?—Certainly.

5360. Then the whole property of the town has a value, a portion of which is represented by the accommodation afforded by the river Lee?—Very largely so, and I believe that the town would be destroyed if the Lee was annihilated.

5361. As a navigable river?—Yes.

5362. Are you aware nevertheless that this town deriving such large benefits from the Lee pollutes the river by draining its sewage into it?—The river Lee is a natural drain or sewer.

5363. It is a natural watercourse to which all the waters of the district flow down?—Yes, on both sides.

5364. Cannot you imagine an arrangement by which an interception might take place, and the sewage of a town like this might be prevented from flowing into the Lee?—I think it is very desirable that it should be done, and I think it might be done by having intercepting sewers on each side of the river.

5365. If the trustees of the Lee had adequate powers given to them by Parliament, and an equitable arrangement was made by which the necessary funds were furnished, do you think there would be any difficulty?—I do not think so.

5366. You could preserve the navigation, and you could vastly improve the town without doing injury to any person?—I believe that the town would not be improved unless there was a better water supply.

5367. Is not that question rather for the inhabitants of the town?—It is a question of cost. When this district was put under the control of the Board of Health I was chairman of that board, and the question, of course, came before us in every aspect, not forgetting, of course, the expense, and we employed an eminent engineer to survey the district with a view to a water supply and drainage, but the cost appeared to be so great that it was really thought it would ruin the town.

5368. A good water supply, I presume, you will admit, is essential for the health and comfort of the inhabitants?—Yes.

5369. Do you not think, if it could be proved that the inhabitants might be supplied with water, say, at 10*s.* per annum, to be delivered by high pressure and constant service into any room of a house, that the well and the pump would be an extravagant mode of doing it, compared with a supply within the house at 10*s.* per annum?—I think it would be desirable to obtain such a supply, and to get rid of the well.

5370. If it can be shown that waterworks might be established in this town, and that water might be delivered within the four walls of a dwelling at the price I have named, would it not be most desirable to obtain it?—Yes.

5371. Every gallon of water weighs 10 lbs., which involves extra labour for servants, and we know that a pump and a well are liable to contamination from many sources?—Yes, there are in this town many distinct wells; it is a poor town, and there is a large number of the labouring population in it; the cost of supplying them with water is nothing at all; it is more the cost of shoe leather.

5372. If you could furnish to the inhabitants of those cottages an abundant supply of water at 1*s.* a quarter, less 25 per cent. if paid by the landlord, the well and the pump would become a nuisance?—Yes, but I have no doubt there would be great difficulty in raising the necessary capital for the works. No doubt it would be beneficial, if the money was forthcoming, to raise 15,000*l.* or 20,000*l.* for this town; but if that were attempted to be done you would drive many of the inhabitants out of it. We should have to levy 1*s.* or 1*s.* 6*d.* in addition to 3*s.* or 4*s.* for poor rate.

5373. You probably heard it stated this morning that fever is prevailing in several parts of the town, that typhus fever, typhoid fever, measles, and scarlet fever have occasionally prevailed, and that there is a large infantile mortality?—Yes.

5374. I believe you are deputy-chairman of the quarter sessions?—Yes.

5375. Does that bring you into collision with cases of pollution or of nuisances caused in the county?—No, nothing except what has occurred under the late cattle plague arrangements. We have had occasion to prohibit the passing of manure.

5376. While you acted as chairman of the local board in Ware what were your practical difficulties in carrying out sanitary works; had you to discuss at the board what you must or not do in order to avoid getting into a dilemma, as the Hitchin people did?—Yes, I think our great difficulty was a want of funds and a proper outfall. We had the district surveyed, and I was very anxious that a reasonable sum should be raised in order properly to supply the town with water, but the sum that it was found would be requisite was so great that the board generally objected to it, and the inhabitants particularly. I do not believe they would have returned any member to the board who would have been favourable to carrying out that scheme.

5377. At what rate of interest did you borrow the money that was laid out in sewerage?—5 per cent.

5378. That, with a sinking fund, I suppose, would bring it up to nearly 7 per cent.?—Not quite so much.

5379. If Government could be induced to lend money for sanitary purposes at 3½ per cent., and take it back by annual instalments, extended over a period of years, would that be a relief to you?—Yes, no doubt of it.

5380. We know that ratepayers are sometimes alarmed about rates, because they do not see the advantage to result from money being advantageously laid out?—Quite so, but really my opinion is this, that those who get a better commodity should pay something more for it—that is to say, if the river Lee trustees have sold the water of the Lee to the London water companies, and in future should get by arrangement a better supply of water, they should pay something more for it. I think that that would be fair and equitable.

5381. (*Professor Way.*) Provided there is no right on the part of any person to foul the water?—I hope we shall not get into law, but I do not think this district will give up their legal right.

5382. The question is, whether the people have a legal right to foul the water of the river?—They have a prescriptive right to use the river, that is what

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I understand. Then again a concentrated drain is far worse than drains which enter at different points; we see that exemplified in this district by the drainage of the New River Company coming in and poisoning the water most terribly with what I may call the concentrated essence of the sewage from Hertford.

5383. A number of outfalls merely have the effect of distributing the nuisance so far as the people residing near are concerned, but what do you say as to the people who reside many miles below; would the number of outfalls here make any difference to them?—Yes, a great deal more water comes in with the foul matter.

5384. If a certain quantity of sewage is poured into the river 20 miles above, does it matter whether it comes in through five pipes or 20?—That is the question.

5385. It appears to me to be a distinction without a difference?—I think there is a difference.

5386. Do you think that you have a prescriptive right to throw what dirt you like into the river Lee?—No, but I think I have a right to use a drain as it has been used from time immemorial.

5387. You think that you have not only a legal right, but a moral right?—If I thought it was injurious so to use it, I think I should not have a moral right.

5388. (*Mr. Harrison.*) I believe the law is that no length of time can legalize a nuisance?—Yes, I think it is so.

5389. Therefore you can never gain a prescriptive right to commit a nuisance?—Yes, but the question is, what is a nuisance?

5390. (*Chairman.*) I believe you are the proprietor of large brick-fields in this district?—Yes.

5391. Do you employ the river largely for carrying purposes?—My tenant does.

5392. Do you bring the materials up from London, the breeze, and so forth?—Yes.

5393. And are your bricks taken down?—Yes, in very large quantities.

5394. What do you get per 1,000 for them?—There is such a variety of makes; the price varies according to the kind of bricks.

5395. Do you know the character of the land in the neighbourhood?—Yes.

5396. Do you remember any plans being prepared for storage reservoirs in this district?—Yes, very elaborate plans were got up by Mr. Rendel.

5397. Did you form any opinion as to the advisability of constructing those storage reservoirs?—I thought it most desirable that reservoirs should be constructed.

5398. If the water companies could construct them, I assume that they might have comparatively pure water for the supply of London?—Yes.

5399. Instead of taking the water of the Lee?—Certainly.

5400. Do you know the sites upon which those reservoirs were proposed to be made?—Yes, I know two or three of them. I think one was in Hatfield park, the intention being to stop the water of the Lee.

5401. Would the Marquis of Salisbury allow that to be done?—I think it would be a question with all of us, a question of compensation, and whether the reservoirs were made ornamental or not, and so as not to be left entirely dry at times, and so on.

5402. It would be a question whether the embankments were so constructed, and in such a position, as to be safe?—Certainly.

(*Mr. Marchant.*) The Marquis of Salisbury was a strong promoter of the scheme.

(*The witness.*) I may mention that I am chairman of the Regent's Canal Company, which is a very large navigation in point of tonnage, and the whole of the water which is supplied to that navigation, except what comes from the Grand Junction Canal and in very dry seasons from waterworks companies, is storage water; there is one reservoir covering 220 acres, and capable of storing 70,012,000 cubic feet of water.

5403. Could you obtain from your engineer a return as to the tonnage which is passed along that canal, and as to the volume of storage water?—Yes, without any difficulty. I could give you the revenue now, but I will furnish you in writing with the length of the navigation, its tonnage, the area covered by the reservoirs, the cubical capacity of the reservoirs, the annual volume of water used, and the area of the gathering grounds. The valley of the Lee from which all these rivers come is like a sponge; it contains a vast quantity of water, of excellent quality, and if the river was deepened, and the storage water used for the navigation, I think, then, that the spring water might be taken to London, and the navigation be entirely supplied from the reservoirs.

5404. You think that the spring water should be preserved for the supply of the metropolis, and the navigation proper should be supplied from the catchment reservoirs?—Yes.

5405. All you want is water in the navigation to work the lockage?—Yes.

5406. (*Mr. Harrison.*) Still, I presume, you would not approve of the towns discharging their sewage and other refuse into the navigation?—No; but, as I have said before, you must consider the money question. We are very poor in this district.

(*Mr. Mylne.*) The trustees' scheme of 1851 contemplated storage reservoirs of 994,000,000 cubic feet. The reservoirs were to be on the Ash and the Rib—one in Amwell marsh, two on the Lee, one above the other, on Roxford farm, and the other above Hatfield park, and a small one near Ware mill lock, which is not included in the 994,000,000 of cubic feet. The Ash and the Rib were to hold 500,000,000 cubic feet.

5407. Would those reservoirs receive chiefly spring water which would be almost entirely free from pollution?—They were to be catchment basins for a certain drainage area, taking in the surface water and spring water.

5408. Do those areas contain a very sparse population as compared with other districts?—I do not refer to the Lee Proper. There is Luton and Dunstable.

5409. Was it part of the scheme to divert the sewage of Luton?—I do not recollect the details of that scheme.

(*Chairman.*) To what amount of tonnage do you restrict your tenant?

(*Mr. Rydon.*) It would come to about 25,000 or 28,000 tons that I am to pass up and down annually.

(*The witness.*) I have made a private cut of my own for other purposes, which would perhaps bring 10,000 tons out of the river Lee into my own ground at my own expense.

5410. Upon that cut you would probably convey something like 10,000 tons per annum?—Yes.

5411. Making about 35,000 tons in all?—Yes.

5412. (*Mr. Harrison.*) You probably know that there are at the present time upwards of 40,000,000 of gallons of water taken in from the Lee to London daily for drinking purposes by different water companies?—Yes; this may be so.

5413. That forms a very large proportion of the whole supply given to London. From the Thames they take only 48,000,000 of gallons?—Yes; this may be so.

5414. Therefore the Lee is one of the most important sources of supply to London?—Yes.

5415. Do you think that the formation of reservoirs such as you have mentioned, which would hold 994,000,000 of gallons, or about 25 days supply, would be the best means of providing a supply at present for London?—No. I think that the river ought to be deepened. I believe that the whole valley is like a sponge, and that the water does not get away.

5416. What steps do you think it would be advisable to take to put the river Lee under good management, so that it might be made in the highest degree beneficial to the public, both for the navigation, and for a

supply of water?—I think there should be a good engineer to manage it, that the navigation should be deepened, and the locks enlarged, in short, that Mr. Rendel's plan should be, to a great extent, carried out. I would lessen the number of the locks, lower the bed of the river, and save the water that would otherwise go away by evaporation and in other ways.

5417. Under what kind of management would you place the whole valley of the Lee in order to attain those ends?—It is a difficult thing to say what it would be best to do.

5418. Are you at present one of the trustees of the river Lee navigation?—Yes.

5419. Do you think that the river Lee trust would be able, with extended powers and adequate authority, to carry out a system of the kind?—I should say that there ought to be a joint management. I think this, that those who have an interest in affairs of this kind, generally manage them better than those who have not. Some of the members of the New River Company are *ex-officio* trustees of the river Lee trust.

5420. Do you think that the whole valley of the Lea is in an unsatisfactory state?—Yes, I think it is.

5421. Would you be inclined to carry out a system of drainage throughout the valley as it exists?—Yes, and get rid of many of the mills. Many of them in Hertfordshire are extremely detrimental, not only to land, but to the value of property where the water is headed up.

5422. Is it at times the fact that water so headed up by mills injures a larger amount of property by flooding, there being a want of drainage, and does more damage than the mill itself is worth?—That is a question I cannot answer, for it is very difficult to ascertain the injury that is done to land by these heads.

5423. (*Chairman.*) Do you know that there are certain mills which do inflict injury upon the adjoining land, and do impede the drainage of the valley?—I should say that every mill in the county more or less does so. I do not know of one that heads up the water and does not injure the land adjoining.

5424. Are you not of opinion that we have glided into an age when steam may fairly be said to have superseded water power?—Yes, I think so.

5425. And probably it would be much better to sweep away the mills and substitute another form of power, water mills being now out of date and things of the past?—Certainly; and it is very much the fact of railroads passing nearer to modern mills which has made the older mills valueless, cartage to any station being too far.

5426. In the primitive state of the country, when there were few roads, and land had a very small value, and when people had comparatively no knowledge of artificial power, mills were a necessity?—Yes.

5427. They were put up to grind corn and make flour for the people of that period, but now machinery and the means of rapid communication by railways enable you to bring flour from distant parts, and the necessity for a mill no longer exists?—That is very much so.

5428. A mill now blocks the drainage and injures the adjoining land, to what extent you cannot say?—No.

5429. You can say that it blocks the drainage and injures the adjoining land?—Certainly.

5430. (*Mr. Harrison.*) Do you think that the river Lee trust might be re-constituted, and a board be formed that should at once improve the whole value of the Lee by carrying out drainage works, maintaining the navigation, and provide at certain points, to be carried away by water companies, a large supply of pure water for London?—I think there is quite material enough to carry that out.

5431. How should you say that funds might be raised to carry out those several objects?—Funds would be raised by showing that the scheme would be a profitable one.

5432. If you were to carry out drainage works, it would be necessary to have taxation in some form or other?—Yes.

5433. Upon whom would you levy the tax?—I think it should be divided in portions—for instance, I should say, if a town was drained, a third of the amount should be contributed by the town drained, and two-thirds by the London water companies who would get a better supply of water, and so divide it into small sums. Again, if you could show that the land was benefited, I would place a small tax upon the land.

5434. (*Professor Way.*) Your point seems to be, to exact from the metropolis some contribution towards purifying that water which you have made impure, and the more impure it was the more they must pay?—No, I do not mean that.

5435. You seem to argue that you have a right to make the Lee impure?—It is impure; and let me mention, that there was a negociation of a business-like character carried on between the East London Water Company and the New River Company, and they made a bargain, and surely if the bargain had been, you must first purify your water, we should have said, very well, let this arrangement stand over for a time, and we will ascertain what the expense will be, and when we have done that, we will make you pay for it accordingly.

5436. The question is whether anybody has a right so to use the water as to abuse it and pollute it. If you say that you have a right so to use the water, there is an end to the question?—But we do not do it.

5437 I presume that none of the people here would wish to represent through this Commission that they consider they have a right to make the Lee impure?—Yes, they do. I maintain that we have a right to drain into the river Lee.

5438. And a right to make it impure?—No, I do not say that.

5439. The opinion which you have expressed you would probably not apply to another river in which you had no interest?—I think it would be a question for the House of Commons as to what sort of Bill should be passed to deal with those matters.

5440. It is not a question of principle with you, it is a question of pounds, shillings, and pence?—We must consider the expense.

5441. (*Mr. Harrison.*) With regard to the constitution of the river Lee trust, do you think that that trust represents local interests as fully and as sufficiently as you would wish?—Yes.

5442. (*Chairman.*) If you had such important duties entrusted to a board as those connected with the conservancy of the river Lee and its tributaries, do you think it would be advisable that its numbers should be unlimited, or that its jurisdiction should not be clearly defined?—I think the question is whether these gentlemen are competent to carry out an Act of Parliament.

5443. If there is power to elect 500 people to qualify, the question is whether the Board would be as well managed by 500 persons who could so come in as it would be by 50 who came in by right, and could not be interfered with by any greater number?—I think the question is, is it advisable to limit the Board in its arrangements; we appoint committees and sub-committees.

5444. Are you a county magistrate?—Yes, and I am deputy-chairman of Quarter Sessions.

5445. Do you ever appoint any public officers?—Yes.

5446. Do you as deputy-chairman of Quarter Sessions attend pretty closely to your duties?—Yes.

5447. At the sessions or at any other meetings, how many magistrates on the average attend?—For the county business I should think probably 30 or 40.

5448. How many magistrates are there in the county?—I really do not know.

5449. 300?—Probably 150.

5450. Have you sometimes appointments to make in the county?—Yes.

5451. When you have an important appointment to make, how many magistrates usually attend to vote?—The post of Chief Constable I believe is the most

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popular thing in the county, and I believe all the magistrates muster then.

5452. You mean I suppose that those magistrates who transact the ordinary business of the county are not left to make appointments themselves, for those who seldom or ever come near at other times assemble numerously upon those occasions?—Yes, the Chief Constable is the constable for the whole county, A great deal of the county business is done at the Petty Sessions.

5453. Is the fact that the men who from their constant attendance transact the business of the county are over-ruled in the appointment of so important an officer as Chief Constable by gentlemen who never attend except on that occasion?—No.

5454. (*Mr. Harrison.*) Does not this matter require a little qualification, that although there may be only 30 or 40 magistrates who attend the Quarter Sessions usually, you will find five or six magistrates probably attending each of the Petty Sessions where they have to some extent the local management of the police?—Yes, of course that is so.

5455. Therefore the magistrates who attend each of the Petty Sessions are interested very materially in the appointment of Chief Constable?—Yes, and if there is any business connected with any part of the county—the county bridges for instance are an important question—then the Quarter Sessions are attended by every magistrate in that locality, and it is of great use and advantage for those gentlemen to give us their opinions, we are very glad to hear the opinion of the gentlemen living in the locality in which the business is required to be done.

5456. (*Chairman.*) Do you not find any practical inconvenience from having so large a Board in the transaction of business?—No, the only difficulty is this, that at times we do not get the same number of magistrates in attendance as we should like.

5457. (*Professor Way.*) Is not that a practical difficulty?—That is one. The chairman makes a point of attending and also the vice-chairman, and some others do the same.

5458. You have been asked by Mr. Harrison whether in the case of some conservancy body being formed for the valley of the Lee, the existing body of trustees would be fit and proper persons to perform the duties of such a Board?—Yes.

5459. Is it a fact that the Lee trustees at present consist of 60 or 70 members?—Yes.

5460. Are some 23 or 24 of them aldermen of the city of London?—Yes, all the aldermen of the city of London are *ex-officio* members.

5461. Are the other *ex-officio* members principally members of Parliament?—All the other *ex-officio* members are members of Parliament.

5462. How many members of the River Lee Trust altogether are interested in the land and property of this district, are the aldermen of the city of London so interested?—No.

5463. Are the county members interested in the land and property of the district?—The borough members are.

5464. Supposing that 24 members of the trust are aldermen of the city of London, and some 30 more consist of the members of Parliament for this district, some who are not members for this district, and others, what interest do you think preponderates?—The river Lee Navigation commences at Hertford, and we have the Marquis of Salisbury, the Mayor of Hertford, and we have two or three traders and the Ex-Mayor of Hertford. Mr. Squires is a trustee having a very large mill on the stream or two I believe. I come next to Mr. Baker who lives higher up above the navigation; he is a trustee, and his son also is a trustee.

5465. How many aldermen of the city of London have any interest in the matter?—I do not know that any of them have, but they come down sometimes.

5466. Have they any right to interfere in the business of the trust?—Only as *ex-officio* trustees.

5467. They form rather a large element in the trust?—Yes, then adjoining me Mr. Gosselin, a landowner, was a trustee. Mr. Puller is a trustee, and his son also; Mr. Page, the largest maltster in England, is a trustee, and in fact I do not know of anybody who is not a trustee, if he is thought to be a desirable man. The last trustee appointed was Mr. Baxendale, who lives about two miles from the river.

5468. Is it a fact that 30 members of Parliament are *ex-officio* trustees?—(*Mr. Marchant.*) I think you may take the number of members of Parliament at 10, they are only the members of the counties through which the river passes, and they are parties who live in the counties through which the river passes.

5469. (*Chairman to the witness.*) Do you think that the business of the trust would be worse managed if the number of the trustees was reduced to about 15, if the present trustees were made simply an elective body, and not an executive body, and that the first requisite for an acting trustee should be qualification by property, or interest in the district, or the navigation up to a certain sum; and above all things that he should be resident?—I think that that would be an improvement.

5470. So that the present body should elect the representatives who were to be the executive?—Yes, I dare say it would be better done then.

5471. (*Professor Way.*) Supposing a new arrangement was about to be made for the control and management of the river Lee, would there be any possible reason why 24 out of 60 or 70 members should be aldermen of the city of London and *ex-officio* members?—I should not think that necessary at all.

5472. (*Chairman.*) If Parliament should think fit to create an acting body of trustees, limiting their number, and putting more duties upon their shoulders, do you not think it would be just that Parliament should provide that at all events the members of the body should be repaid all expenses out of pocket like the Thames Conservators, for example that 1,000 or 2,000*l.* a year should be divided amongst the executive body who did the actual work of the conservancy, and not as a payment for services rendered?—You know better than I do, that if it comes a question of payment, you do not get the best working men from the men who are paid, on a trust of this sort.

5473. I do not mean men who are paid, but you are aware that in railway companies and other large companies an annual sum is voted to defray the expenses of the working directors?—Yes.

5474. Why should you be called upon to give up the whole of your time for the public of London to furnish a water supply, to look after the navigation, and the interests of the landholders above and below you, as well as your own small portion of it for no equivalent. How could the public expect you would do so heartily if you had to put your hand into your own pocket every time you attended a meeting?—It is part of the system of England that there should be a number of gentlemen so engaged, and I should be very sorry to see the duties of the magistrates of England put into the hands of those whom we paid for attending to them.

5475. (*Professor Way.*) The object of my questions was to ascertain whether your Trust was really a body which represented the interests connected with the river Lee, and whether, if any legislation should take place, we as commissioners would be justified in saying, we believe that the trustees would be the proper persons to carry out that legislation. For my own part I cannot see why 24 aldermen of the city of London out of a body of 70 should have any right to vote?—I may state that they do not attain that position without being men of very sound sense and having good heads upon their shoulders; and such men are extremely valuable.

5476. I presume it would be your object that the members of such a body should really represent the interests connected with the river Lee?—Yes, with regard to payment that is another question, or whether

there might not be a paid chairman, you would have to throw a great responsibility upon somebody, and if you could throw a great responsibility upon any individual, I think perhaps you might pay him.

5477. In the case of the river Thames, Parliament takes the conservancy as it exists, and makes its arrangements for the future treatment of that river, and if Parliament is to deal with the river Lee it may turn its eyes upon the present trustees as a fit and proper body to manage the river Lee. We are simply asking you whether you think, without considerable modifications, they are an eligible body for the purpose?—In my opinion they are quite capable of doing it, and as capable as anybody that can possibly be found.

5478. (*Chairman.*) One great question is, the question of numbers?—Yes.

5479. And when we are looking forward to the future, and we see that certain additional duties will have to be put upon some board for the preservation of the navigation and to maintain the purity of the water, the question is who is to constitute that board?—I have given you my opinion with regard to the present trust.

5480. You are chairman of the Regent's Canal Company?—Yes.

5481. Are the gentlemen who serve on the board and conduct the business of the Regent's Canal paid?—Yes; we receive 1,000*l.* a year among 15.

5482. (*Mr. Harrison.*) There are two questions here, first, whether you think the present trustees represent fully the local interests connected with the Lee, and secondly whether the same trustees would be a proper constituency to whom should be entrusted the power of electing a good working board say, of 15 or 20 members, and in order that they should not be out of pocket, whether a sum like 1,000*l.* a year to cover their expenses, might not be allowed?—I think that the body from which they are elected cannot be improved.

5483. (*Professor Way.*) For the present purpose, or for any future purpose?—For any purpose; for the navigation of the river Lee, or for any other purpose that might be entrusted to them. I think I stated before that there are some of the directors of the New River Company who are *ex-officio* members of the trust, the governor, the deputy governor, and the treasurer, they do not attend.

5484. Do you think that there is enough water in the valley of the Lee, not only to supply the navigation, but if properly managed to distribute a much purer supply of water to the inhabitants of London?—I think so.

5485. (*Chairman.*) Is there anything further you would wish to add?—Nothing else occurs to me at present.

The witness withdrew.

Mr. Albany Bond (Ware) examined.

Mr. A. Bond.

5486. (*Chairman.*) Are you inspector of nuisances in this town?—Yes.

5487. How long have you held that appointment?—About 3½ years.

5488. What duties have you to perform as inspector of nuisances?—I have to go round and find out any nuisances that may exist upon any premises, or within the district, and report them to the next meeting of the board.

5489. What power have you to interfere and to cause a nuisance to be abated, supposing that you find a nuisance very offensive?—Then I order it to be removed at once.

5490. Do the Board furnish you with funds to purchase disinfectants?—I have had them from Mr. Cobham, the clerk. We have them by order of the board.

5491. Do you obtain as much as you want?—Yes, as much as is required.

5492. With regard to the cesspits and cesspools, if you find them to be the cause of nuisance, what course do you take?—I call upon the parties to have them emptied.

5493. How are they to do that?—We provide them with a soil cart for the use of which they pay 2*s.*

5494. Where is the refuse taken to?—It is taken towards Ware Park and towards a brickfield; that is, it is removed out of the district.

5495. Do you sell it to farmers for manure?—No; there is a hole at the place I am speaking of, and a man covers it over with lime.

5496. But is it not useful as manure?—I should say so, but nobody cares about it here.

5497. Supposing you find there is fever in a house, what course do you take?—I generally take some of the disinfectants or chloride of lime, and have the rooms whitewashed after the patient gets better.

5498. Have you any other duties to perform besides those you have mentioned as inspector of nuisances?—Yes, I collect the rates.

5499. What do the rates amount to in the pound?—The present rate is 1*s.* in the pound.

5500. Do you mean 1*s.* in the pound for the half year?—Yes.

5501. Will the rate be 2*s.* in the pound for the whole year?—The present rate is 1*s.* in the pound, but I do not know what the next rate would be.

5502. How much does the 1*s.* rate produce?—About 800*l.*

5503. And the 2*s.* for the year would produce 1,600*l.*—Yes.

5504. Will you be good enough to explain for what purposes the rate is collected and applied?—(*Mr. Cobham.*) It is for the repairs of roads, and paying off the borrowed money, which is a very heavy item; also for the lighting of the town, to pay the salaries of the officers of the board, for any drainage that may require to be done, and also for paving.

5505. Does the 2*s.* in the pound cover all the local rates that are collected?—(*Mr. Cobham.*) It does, and it would do more than that; but the fact is that we were about to make some drainage works, and we were going to have 500*l.* borrowed by the board, but these works appeared to require such extensive plans that we thought proper to abandon the idea, and the rate was increased in place of borrowing the 500*l.* When I say the board, I mean the board in London. We increased the rate one penny in the pound by three rates, and by that means we avoided the repayment of the money we intended to borrow; therefore a 2*s.* rate is really more than the board want under ordinary circumstances. I think Mr. Bond has been rather misleading you as to the removal of the night soil; the truth is that the board charge 2*s.* for the use of the cart, and for the cart alone, but those who have the use of the cart may employ what men they like, with the exception of one man; they must pay one of the men, but they have a perfect control over him. They take the soil away, but we say they must take it out of the district, and when they have done that, they may do what they like with it. I believe that they sell it occasionally. I happen to know that when they can find a customer they do sell it.

5506. Is there anything further that you wish to add?—No.

5507. (*Mr. Harrison to the witness.*) What kind of place is it into which the night soil is tipped?—It is a gravel pit; the gravel has been taken out and it is filled up with soil, and then covered with lime.

5508. Is the soil ever removed from the pit again?—No, not generally.

5509. What is the size of the pit?—There is a hole here and a hole there just as they can get it in.

5510. Are these holes which have been made for the purpose of taking away the gravel?—Yes.

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5511. And in this way you fill up the gravel-pits?—Yes, with the soil.

5512. Do you find that you can go on tipping into one of these holes a large quantity of night soil for a considerable time?—Yes, perhaps it has been there for 12 months, and has subsided, and then they go again and fill it up again.

5513. Where are these holes situate with reference to the town?—They lie towards the Park.

5514. They are at a higher level, are they not, than the town of Ware?—Yes.

5515. Does the gravel bed into which you throw the night soil extend downwards, and join the gravel bed on which the town is built?—Yes, it does join it; it is on the borders of the road near the cottagers' gardens.

5516. As inspector of nuisances to the town do you consider that the operation you have described may become a nuisance to the town by the sewage draining towards the town through the gravel?—I should not think it would; time may perhaps produce an effect.

5517. You say that this has been done until the pit gets nearly full; then in the course of a year it will sink down, and the pit is ready to receive another supply?—Yes; and so they go round.

5518. The rains of summer, and the water that percolates through the gravel will have taken all that night soil somewhere or other?—Yes.

5519. Is it not quite possible that it may have been brought down again to the town of Ware?—It might have been so; but I am not sufficiently versed in such matters to be able to say.

(*Mr. Cobham.*) I feel perfectly certain that it does not do so. It goes away from the town nearly in a solid state in the first instance, and the next thing is that there happens to be a field of clay adjoining the gravel between the point where it is put into the pits and the town.

5520. In which direction would the gravel pit drain?—There seems to be a bed of gravel for some length, a very great bed of gravel. Mr. Parker's pits are on the one side, and the sewage is put in in such small quantities that I believe there is nothing to apprehend.

5521. (*Professor Way to the witness.*) Are there any vegetables grown near the town for the London market?—No, I think not; not to my knowledge.

5522. Is any manure brought from London to Ware?—Yes, occasionally by the river we have some.

5523. Can you at all account for the night soil being considered so valueless here that you have to throw it into a pit to get rid of it?—No; but no one will have it.

5524. Can you account for its being considered so valueless?—I cannot; if it was allowed by the board, I think that some of the farmers in the district would be very happy to have it on their land.

5525. But the fact remains that this quantity of sewage is thrown into pits just to get rid of it?—Yes.

5526. We have been often told in the course of our inquiries that the liquid part of manure is of no value, and that it is only that portion which remains in a solid state which is useful?—I believe that they are both of value in a certain sense.

5527. Is it not a curious fact that the stuff conveyed to these pits should not be considered worth buying for manure?—Yes, I have thought so.

5528. Do you think it probable that in consequence of these cesspits, whether they be cemented or not, being open to the water, the sewage gets so washed and diluted that it becomes of no value?—I do not fancy that that is the case.

5529. (*Mr. Harrison.*) The surveyor stated that the new cesspits which are formed are cemented, but that a great number of the old ones are not in that state?—Yes.

5530. Have you occasion frequently to call upon the persons owning the old cesspits, to clean them out?—Yes.

5531. Do they fill them up to the top?—Yes.

5532. How often are they emptied?—Some of them once in 12 months, some once in two years, and some according to the state in which they are; it is according to the height it is up to.

5533. Do you know that any of them into which refuse is thrown constantly are never cleaned out?—No, I cannot say that.

5534. How long have you known one of them to be used without being cleaned out?—Three or four years.

5535. (*Professor Way.*) Supposing that this sewage is not worth a farmer's purchase or even his acceptance upon any terms, and it has therefore to be thrown into the pits to be got rid of, does not that seem to indicate that something must have happened to diminish its value?—I am not able to answer that question.

5536. If it has been so impoverished as to be valueless, is it not plain that its value has gone somewhere else, for instance, into the sub-strata?—I suppose it may have done so.

(*Mr. Cobham.*) I may mention that the farmers used to bring a waggon and take it away when they where under no restrictions; or when a privy was emptied the contents were carried into the river Lee. When however they had to come under restrictions, and the night soil had to be removed between the hours of 12 and 4, that seemed to do away with the practice entirely; the farmer wanted a longer time to do it.

The witness withdrew.

Mr. A. Brown.

Mr. Alfred Brown (Ware) examined.

5537. (*Chairman.*) You are a miller I believe?—Yes.

5538. Where is your mill situate?—In the town of Ware, close to the railway station.

5539. What water power do you employ?—I have a steam-engine, and I draw water from the Lee for the purpose of the engine.

5540. What power do you use?—16-horse.

5541. What weight of coals do you use in a week?—I burn a variety of coals; sometimes I have sea coals and sometimes I use Midland coals.

5542. What weight of coals do you consume in a week?—I do not know exactly.

5543. Do you know how many hundred-weight you burn in an hour?—At a guess I should say that I consume perhaps eight tons a week.

5544. How many hours do you work?—Night and day at times.

5545. Is your's a high-pressure engine?—Yes, a high-pressure condensing engine of 16-horse power.

5546. How old is it?—It has been erected about 16 years.

5547. What did it cost you originally?—It is not my own, and I do not know exactly what the cost was, but I think the engine and machinery cost something like 1,600*l.* or 1,700*l.*

5548. How many pairs of stones do you work?—Five pairs.

5549. How many dressing machines?—Only one.

5550. What do you do with the ashes?—We make none, the coal is all burned down to clinkers.

5551. What amount of traffic in weight passes over the river Lee to and from your mill?—The Lee is very useful to me; it acts as a check against the railway company, and it is likewise useful to me as it enables me to get wheat from vessels lying in the Thames. The barges go alongside the vessels, and it is loaded from the vessels into the barges.

5552. You get the wheat up in that way, grind it, and return it in the shape of flour?—Yes, at times we have foreign wheat for the purpose of mixing with the country wheat from the neighbourhood.

5553. Do you suffer from the foul state of the river Lee at any time?—No, I have never done so. I draw

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water from the Lee for the engine; I have a well close by the engine, but that is so silted that I cannot use it; it cuts up the buckets and pumps, and I therefore draw water from the Lee on purpose.

5554. Are there any fish in the Lee opposite to your mill?—A great quantity of small fish; you may see thousands of them all round the place where the condensed water flows into the Lee; these are small fish, the large fish come up there after them.

5555. Are there any special points that you wish to mention to the Commission?—None that I know of.

The witness withdrew.

Mr. Henry Beningfield (Ware) examined.

Mr. H. Beningfield.

5556. (*Chairman.*) Are you a resident in Ware?—Yes.

5557. Do you carry on any business here?—Yes; I am a surveyor and auctioneer.

5558. Upon what particular points do you wish to give evidence?—Relative to the report which I have seen respecting the flooding of the Rye Meads at Stanstead. I noticed it in reading the evidence of one of the witnesses who was examined at Stortford. It was stated that the Rye Meads were now about to be enclosed, and that arrangements were made for their drainage. The question was specially put, and being somewhat concerned in the enclosure, I thought it would be advisable for you to know that such arrangements had not been made, that the valuer acting under the enclosure has received no instructions whatever to drain the Rye Meads, but simply to apportion them out to various parties. No arrangement whatever has been made for the drainage of the Rye Meads.

5559. Then, I suppose, if they are to be drained, that must result from some subsequent arrangement?—Quite so.

5560. Are there any other points that you wish to mention?—You may probably have noticed how immensely they do get flooded, and the fact is, that the water remains there longer than on any others, and I may explain that that arises from three different causes, first of all, the construction of the railway has very much limited and prevented the water from running away, but the greatest reason is the Stort river. There is no escape for the water from the Rye Meads, except under the Stort, and it simply goes through a small hole, that is formed, I believe, by a hollow tree, and all the water passes through it in that particular way.

5561. Therefore you think I presume that a comparatively small expenditure would give relief to a very large area that is flooded?—Yes. I may mention also that there is no exit from the Stort in case of flood, except that which passes through Roydon mill; any surplus water is thrown back as back water, and runs through the old back river, and so is thrown on to these Rye Meads.

5562. To whom do the Rye Meads belong?—The land is Lammasland, and it belongs to a variety of persons.

5563. I suppose it would be allotted to several people?—Yes. I believe that no effective drainage can be carried out unless the parties can agree upon some one plan. The valuer has applied for power to drain the meads, but the parties interested would not give their consent. This is all I have to mention.

The witness withdrew.

Mr. John Marchant, jun. (Hertford), further examined.

Mr. J. Marchant, jun.

5564. (*Chairman.*) You have some documents which you promised to furnish the Commissioners?—Yes, I produce an "Abstract of the receipts and payments of "the trustees of the river Lee" from the year ending 31st December 1856, and downwards to the year ending 31st December 1865. I have also appended a statement showing the result of the operations of the trust upon the revenue account, to show that the operations have been successful, and that we have not expended more than we were warranted in doing (*handing in the same*). Evidence was given at Hertford by Mr. Manser in which he seemed to reflect upon the management of the trust, and seemed to think that we ought to have in hand a large surplus to pay for any extraordinary expenditure. I show by the papers handed in that we have not overrun the expenditure. I will also put in an "Abstract of trade for the year end-"ing 31st of December 1865, showing the amount of "tolls received at different points upon the river" (*handing in the same*). I also produce the form that we adopted in the year 1864, to serve upon every person whom we found creating a nuisance in the navigation (*handing in the same*). We sent a number of these forms to different parties, but having no parliamentary power to carry them out, we found that they were insufficient.

5565. (*Professor Way.*) Will you be kind enough to state whether the trustees are changed from time to time?—Not by rotation, a change is caused only by death, unless on the ground of nonattendance for a certain period, that will disqualify.

5566. Are the members removed if they become disqualified in that way?—In practice they seldom return to act.

5567. How often is the body really changed?—It is difficult to say, because it is principally by death, almost entirely by death, that any change takes place.

5568. (*Chairman.*) Will it be fair to ask you whether you have formed any definite opinion, and that you wish to express, as to the constitution of the trust?—My opinion is distinctly this, that a certain limited number of trustees, or a limited body of any kind will generally act better than a body unlimited in numbers. The points which you have elicited to day from the witnesses go quite to this opinion, that you ought not to have so large a number that a majority can come in and swamp the rest upon any question by being whipped up at a particular moment. Such a power I think ought not to exist.

5569. In your opinion would a limited and properly defined body be better fitted for active work than an unlimited and ill-defined body?—As a general principle, I should say, yes; but we have not found any practical difficulty with the trust, it has worked marvellously well. I believe there were days many years ago, perhaps 30 years ago, when, if certain questions were coming on, there was a whip up, and those who were interested in the questions to be decided won the day as against the judgment of those who were not so particularly interested. I have heard my father say that there were days when 50 trustees were brought to a meeting by a whip up for particular purposes, and that is certainly not a condition of things which I think is desirable.

5570. You do not think it would be right that the acting working trustees, upon whose shoulders the burden of the business usually rested, should be, if some important arrangement was about to be made, overwhelmed by the votes of trustees who were usually dormant?—No; and if now such a thing were likely to happen, I should challenge the right of a trustee to vote, because I know that if he has absented himself for six months, he is undoubtedly disqualified.

The witness withdrew.

Adjourned.

Victoria Street, Monday, 4th February 1867.

PRESENT:

ROBERT RAWLINSON, ESQ., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, Esq.

LONDON.

B. Denton, Esq.

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BAILEY DENTON, Esq., examined.

5571. (*Chairman.*) You are a civil engineer?—Yes.

5572. You are very largely engaged in drainage and other engineering works?—Yes.

5573. Has your practical experience been extended beyond England to Scotland or Ireland?—Yes; I have recently reported on the large estate of Connemara, in Ireland, belonging to the Law Life Society, and I have had many foreign works to report upon, both in Italy and France.

5574. How many years have you been in practice as a drainage engineer?—20 years.

5575. Have you any idea as to the acreage you have dealt with in round numbers, within a few 1,000 acres?—I should think something like half a million, in some way or other.

5576. I suppose I may take it for granted that in that area your experience has been in soils and subsoils of very varying and diverse characters?—No doubt; although my practice has not been so much in town sewerage, yet, I have had a share of that business also.

5577. Besides land drainage, I believe you have been consulted and concerned in carrying out river improvements?—Yes, considerably; district drainage, as I should term it.

5578. Including the improvement of river and streams?—Yes.

5579. I believe you furnished us with information about that in the evidence you gave before?—I did.

5580. Do you frequently find that land drainage to be properly carried out, involves the dealing with streams and rivers, and occasionally more or less with mills?—Decidedly, and in the evidence which I gave before this Commission with respect to the Thames Proper, I explained in what way the drainage of land was very much prejudiced by the condition of the rivers and tributary streams, and by mills. I also explained, I think, that there was a great prejudice against mills, which might be overcome if the proper treatment of rivers was well understood. I believe that drainage may be made the means of very much improving the water supply of this country, and by a proper division of the main valleys into subordinate districts, the mill power may be very much increased. In some instances the improvements I should suggest would involve the destruction of mills, but in many others it would lead to the improvement of the power of the existing mills, and to the establishment of new ones, which, in the aggregate, would amount to much more water power then now exists.

5581. In your land drainage operations, have you adopted and carried out what is termed deep drainage?—Uniformly.

5582. Does that mean deep draining of from four to six feet?—It means starting with a minimum of four, to suit the depth to the difference of subsoil, and in many instances I have gone from 10 to 15 feet deep for the main under-drains.

5583. Besides being acquainted with the valley of the Thames and the valley of Lee, are you acquainted with the other water sheds of England, such as the Severn or Yorkshire valleys?—I might almost say that my operations have extended nearly to every river shed in the country, because that is very nearly the fact. I know of very few rivers upon which I have not carried out some operations.

5584. Have you noticed in the public newspapers that in the last month or three months there have been very destructive floods, especially in the northern parts of Yorkshire?—Yes.

5585. Without pressing the matter further, is it your opinion that that state of things is a disgrace to us as a civilized people, and that we should have now to suffer such enormous destruction from floods in that part of the country?—No doubt, but the difficulty of dealing with it is immense, from the circumstance that the injury is accruing and is cumulative, and what may be a correct mode of dealing with it to-day may not be sufficient to-morrow, the addition of water from under-drainage very much affecting the question. I am also led to the conviction that under-drainage, which is various in result, is nevertheless so uniform in producing a benefit of one sort or another, that it is certain that all the wet lands of this country will be drained in the course of time. With the under-drainage of land, which should have the effect of reducing floods, there is necessarily an improvement of outfalls, by straightening and deepening and keeping clear the watercourses; and although the water of under-drainage is detained in the soil as the rain passes from the surface to the 4-feet drains, yet what is collected from the under-drains with that which flows over the surface to the outfalls, is so quickly discharged by the improvement of those outfalls, that the effect upon the rivers is great, and it will be greater every day.

5586. Are you aware that until this autumn it was a very popular opinion, at all events it was all through the Aire and Calder district, that floods had diminished; evidence was given day after day to that effect, and the witnesses seemed to anticipate that they would never have any more. But while this Commission was sitting, floods came that damaged them to the extent of thousands of pounds?—I am aware that that idea, founded upon ignorance, did prevail, but I have done my best to correct that impression, although my influence is very small.

5587. Do you really think that the under-draining you have spoken of affects so seriously the question of river flooding as to account for the damage which has been done by them?—I do not say that it accounts for it wholly, because there are many other causes, for instance, the silting up of rivers from the influx of sewage, and various effects which it will be necessary to take into account to explain it; but that the discharge from under-drainage now proceeding and accumulating every day does throw down the water at a greater rate than it did before is quite certain, although I admit at the same time that if we could deal with the under-drainage only, the floods would be diminished.

5588. Are you sure that it sends the water down more quickly in all cases than it did before?—Yes, as far as observation enables me to judge of it.

5589. Take as an example 10,000 acres of a retentive clay soil under-drained to the extent of 4 or 6 feet, and more or less porous, are you certain that from that area the flood water is sent down more quickly than it was before it was drained?—I should observe that I have gone very carefully into this matter and made experiments, which have been published in the Royal Agricultural Society's Journal, and I think I have shown to demonstration that the efflux of water out of a soil by under-drains is, after a repetition of rain for several days, almost uniformly half the fall in 24 hours, I therefore deduce from that, that if there are outfalls properly made to discharge that efflux into the river, and in addition to the water that passes

through the soil there is a large quantity of rainfall which never does enter the soil, which must in rapid rains and great falls pass over the surface without entering it; then the discharge of the under-drains, plus the surface discharge quickly let down as it is into the rivers by improved outfalls must lead to a great accumulation of water in the main valleys.

5590. (*Mr. Harrison.*) I think you mean that when the soil is thoroughly saturated from the surface to the drains, and so saturated that the rainfall subsequently runs off the surface simultaneously with the full discharge from the drainage pipes, then, after a continuance of rain the discharge into the river is greater than it was before the drainage was carried out?—Decidedly; but allow me to explain, even by repetition, what I would say upon this point,—when clay becomes full to repletion, that is, when it can hold no more, the water falling upon the surface acts in two ways, first coming upon the water in the soil it presses out and takes the place of the latter which is directly discharged and about amounts, as I have said, to half the rainfall; and secondly, that which cannot enter flows off the surface and goes away by what I call land gutters, and passes to the tributaries of the rivers, and by those down to the main valleys. Let me say again that this is a very important philosophical question; if the outfall discharged the water of under-drainage only, I think, upon the whole, floods would be diminished, that is to say, the number would be reduced, though when the rainfall exceeds a certain limit they would be increased in quantity of water.

5591. You mean, I think, that this excessive discharge into the rivers only occurs on rare occasions when there has been such a continous rainfall for days that the soil is thoroughly saturated, and there is a discharge from the surface simultaneously with that from the drains?—Exactly.

5592. That does not occur after most heavy rains?—Perhaps not.

5593. (*Chairman.*) To return to the river Lee, have you considered that river in all its tributaries with any particular view to the improvement of the streams, the water supply, and the land in the valleys?—Yes, I have, and the extent to which I have gone will appear from the evidence I propose now to give.

5594. You are aware that the Lee is a navigation for a considerable portion of its length?—Yes.

5595. That it also is a very large source of water supply to the eastern part of the metropolis?—Yes.

5596. The water of the East London Waterworks Company and the New River Company being entirely drawn from the Lee and its tributaries?—Yes.

5597. And that the East London Water Company and partially the New River Company are in some degree concerned with the navigation works, that is to say, that the water which they take has been used for navigation purposes before it comes to their lowest point of abstraction?—Yes.

(*Mr. Beardmore.*) That would apply to the New River Company to a very small extent.

5598. (*To the witness.*) Will you be good enough to describe the points to which you wish to draw our attention?—I should preliminarily observe that I was led into the question of the drainage of the valley of the Lee at the instigation of some of the landowners of the marshes of East and West Ham, including what is called Plaistow marsh. The plan which I now produce was prepared with a view to the formation of this area (*pointing to the plan*) into a district for its drainage which I have partially explained in the paper you have before you.

5599. (*Mr. Harrison.*) The object was to drain it so that it should become capable of being built upon?—Yes.

5600. What is the level of that surface (*pointing to the plan*) as compared with Trinity high water-mark?—The section that I propose to put before you, and which you may find useful will explain that particularly. This (*pointing to the section*) is the surface of the marsh, and this is Trinity high-water mark, that (*pointing to the same*) is Ordnance datum.

5601. The whole of this area appears to be several feet under Trinity high-water mark?—Yes; in fact it occupies something like a mean between the two, Trinity high-water mark and Ordnance datum.

5602. What is the difference between the two?—12 feet 6. The views entertained by the landowners at West Ham in consultation with me were, that this was a district essentially valuable for dwellings for the labouring classes, not valuable for a high class of buildings; that it was also peculiarly available for the establishment of obnoxious trades which we wish now to expel from the metropolis.

5603. Is it not now being built upon for that purpose?—No, I know of no buildings on the great part of the marsh, but that this is the right view is proved by the fact that at the present moment there is a bill before Parliament for the consolidation of the various gas companies of the metropolis. I believe it will be brought forward or encouraged by the Metropolitan Board of Works, whereby the manufacture of gas will take place in the parish of North Woolwich, adjoining the outlet of the northern outfall of the main drainage of the metropolis, with a frontage to Gallions reach, and with a line of gas pipes following as nearly as possible the line of the main drain which I have proposed for the drainage of the district, and over which I have proposed also to construct a road so as to open up this wide and large area.

5604. That line is about midway between the northern outfall sewer, and the northern edge of the Victoria Docks?—Yes. I bring these objects before the Commission because I really think they are worthy of consideration in any scheme of drainage that may be carried out. This area comprising 1,800 acres of land is particularly suitable for the dwellings of the lower classes and for the location of obnoxious trades.

5605. (*Chairman.*) You are aware perhaps that all this district of West Ham and part of Plaistow has been sewered?—I am quite aware of that, still the larger part of the land there remains in its primitive condition.

5606. (*Mr. Harrison.*) Are you aware that in the agreement or arrangement made for an outfall at West Ham at this spot (*pointing to the plan*) it was always fully intended that the sewage of West Ham should be carried eventually to a lower part down the river?—I was not aware of that.

5607. Is the drainage of the West Ham area coincident, to any great extent, with the area you have pointed out?—It is. I believe that the lowest part of the 1,800 acres I was first proposing to deal with is somewhere here (*pointing to the plan*) in the West Ham meadows.

5608. So that the natural fall is rather up the river Thames than down it, at that particular part?—Yes, the fall of the surface is contrary to the arterial.

5609. Could you make use of the West Ham sewerage system so as to continue it eastward over the remainder of the area, carrying your outfall to the northern outfall sewer near West Ham, and pumping the whole of the sewage into the northern outfall?—I consider it unadvisable to raise the sewage of this district into the northern outfall. I have considered that the Metropolitan Board of Works would object to it, and on grounds of my own reasoning I consider it objectionable. But I wish to state that while this was under consideration, the information sought regarding West Ham led me into communication with Mr. Marshall, of Stratford, the engineer to the local board of West Ham, and he suggested to me that with other parishes of the valley there should be a combination, and that a larger work should be the result; that my original plan, in point of fact, should give way to a more extensive system of drainage. Following that suggestion I was led into communication with Mr. Marshall, no relation, but one of the same name, the engineer of Tottenham, and the design

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I first made was altered to suit the whole drainage of the valley. I think it right to mention that, because we desired to suit the interests of the various parishes. The original scheme that I had formed has very much suffered thereby, for what we might have done has literally now been stopped by the difficulty of dealing with a number of parishes. The result of this joint consideration of the matter was that without altering the site of the drain I proposed for the Ham marshes, but increasing its size and altering its character, it was prolonged up the valley to the Walthamstow marsh ,and from thence took the shape of a fork, passing to the east and west of the river and the navigation. This (*handing in the same*) represents the whole section of the valley; that is the Stratford sewer (*pointing to the same*) of which I believe Mr. Rawlinson was the originator. That is at the point where the sewer which I propose crosses the main sewer from Stratford (*describing*). This is the invert of my proposed sewer, which has a fall of two feet to a mile. meeting Mr. Rawlinson's sewer which is just below Ordnance datum, and therefore more than 12 feet below Trinity datum.

5610. Through the lower part you propose, as I understand you, to put your sewers at such a level as to intercept the sewage of West Ham?—Yes, and then to come on, first by an inclination of two feet to a mile, then by an inclination of three feet, and rising to five, up to a point which I considered was at that time the highest point to which the low-level system of drainage, that is, the lifting system, would apply.

5611. As far as the sewers extend, they would not at all affect the question of the East London water supply?—They would not affect it in any way except this, that in a bill which I believe the East London Water Company have now before Parliament, they propose to extend their reservoirs at the Copper mills, and the sewer that I propose would pass under the intended reservoirs though outside the existing ones.

5612. As far as keeping out sewage from the river Lee, your scheme as you have explained it, would not at all improve the condition of the East London Company's water?—No; they have an intercepting sewer there (*pointing to the section*), and the reservoirs are fed from the water above the point to which the low-level system would apply.

5613. The water is taken from a higher point than the highest of your low-level sewers?—Exactly so, but the district that I would include in those works extends as high as Waltham Abbey, with a view to dovetail into the system the intercepting sewers from those higher grounds marked on the map, the intention being to apply that sewage for irrigation, or for any other mode of purification that might be deemed best, and to allow the overflow from those works of purification to return into the Lee; but in no case would the discharge of the sewage water into the river be above the point of abstraction by the East London Company or the New River Company. I assume that under any circumstances that would be prevented, or rather that the water companies will extend their works upwards to the point where the sewage is radically intercepted. I have prepared a statement of figures showing the cost of the proposed works, and I am prepared to give them to the Commissioners if they think it desirable. The point of discharge would be at the same point as the North London main drainage, and I have provided in my estimate for making a reservoir at Barking creek to hold one million and a half of cubic feet, upon the assumption that 8,000 cubic feet would be brought down if the low-level system were made to this point (*pointing to the plan*) and that it would be there lifted.

5614. (*Chairman.*) What would become ultimately of the whole of the waters brought down there by that system?—My idea was, that the Metropolitan Board of Works might possibly take the sewage into their system of reservoirs with a view to the sewage being carried on for utilization beyond, but failing that, I proposed, as I have just now said, to have an independent reservoir, and that it should conform to the same arrangement as the works of the Metropolitan Board.

5615. With regard to the times of discharge?—Yes, and whatever was done with the sewage.

5616. (*Mr. Harrison.*) If they were obliged to carry it on to the land, you would do the same, and if they discharged it into the river you would do so also?—Yes, with this advantage; that the sewage from the district I propose to form by an amalgamation of the parishes up the valley of the Lee would not be so impure as the sewage of the metropolis; that is, there would be more water in it.

5617 Are you aware that the Thames Conservators have a bill before Parliament this year to obtain similar powers below Staines that Parliament gave them last year, to prevent any sewage being thrown into the river?—I was very glad to see the notice of that bill, but I do not know whether to read it as extending to the river Lee; if so, all the large tributaries of the Thames will be under the conservancy of the present board. I can hardly fancy that they would stop us at Barking creek when there does not appear to be any other way open of discharging it. It must be a very great improvement to discharge it there than where the Stratford sewage is at present discharged, near the mouth of the river Lee.

5618. By this system you would do good thus far, that you would divert all the sewage from near Waltham Abbey downwards on each side of the river Lee, and discharge it at Barking creek, or pump it for irrigation lower down in Essex?—Exactly so.

5619. You would relieve the Lee from all the pollution of the district?—I have divided this plan of mine into three parts, the first being that which must be lifted, and which I call the low-level system, and which is represented by the darker colour on the map; the next is the part from the uppermost margin of the low-level district up to Waltham Abbey; or it may be continued to Feilde's weir, of which the drainage on each side may be intercepted, and after being purified by irrigation or otherwise discharged into the river. But I have assumed that water will not be taken out of the river between those two points for domestic purposes, but above the highest point, Feilde's weir.

5620. Is your scheme one embracing the whole of the valley, or is it merely confined to the lower part?—The scheme that I laid before, or desired to lay before the united parishes for adoption, extended from Barking creek to Waltham, but that consisted, as I hope I have explained in the paper, of two characters of work; the low-level system into which all the sewage must go, and the medium system where the higher land sewage would be intercepted and applied in irrigation, if irrigation should be deemed the best.

5621. You do not propose to deal at all with the towns of Luton, Hertford, Ware, and Hoddesdon?—I have in view the continuation of that plan as I think I have stated in that paper, as far as a united system would facilitate the utilization of the river water for domestic purposes. The third part of my plan was this, to intercept the sewage from Feilde's weir to Hertford, and even to Hatfield on the one side, and to Bishop Stortford on the other, and having intercepted the sewage perfectly bya system of intercepting drains to discharge that sew- age below Feilde's weir.

5622. On to the land?—Yes; for irrigation, or it should be used on its way from Bishop Stortford to Feilde's weir, to run the effluent water into the river in its clarified condition, but below the point of abstraction for domestic use.

5623. Will your scheme appear before Parliament of that general character that you represented just now?—Not so; one of my great motives for desiring to give evidence before this Commission was to show that if that scheme of low-level drainage in connexion with an intercepting system, and the application of the sewage to irrigation is carried out from Barking creek to Waltham it may be continued to Bishop Stortford and Hatfield by an extension of works of a similar character whereby the water of the Lee may be utilized to a very large extent, more than it is at present. I

see Mr. Beardmore present, and I am not at all sorry to promulgate my views in his presence. I consider that a system of interception might be carried out from Feilde's weir upwards by the fork, that is, to Bishop Stortford on the one side and to Hertford and beyond on the other, and that reservoirs or a reservoir might be constructed of very large dimensions below Feilde's weir. I consider that the section which you no doubt are familiar with, the section that was printed of the river Lee, called a profile of the Lee, shows that this can be done very clearly. I consider that a reservoir might be made of large dimensions below Feilde's weir, and the water conducted from above the weir into this reservoir. I do not look to that reservoir as the only means of storage for the Lee, because I am well aware that there are many places in the tributaries of the Lee where reservoirs may be constructed. I know intimately what was proposed by Mr. Rendel in 1849–50 ; I saw great objections to several of his reservoirs when I was consulted on the subject, and when I propose supplemental reservoirs higher than Feilde's weir I am not proposing exactly those which Mr. Rendel proposed. There were some, I have reason to know of those which he did propose, which might be still adopted, while others might take the place of those that were objectionable.

5624. Below Feilde's weir do you get on to the London clay ?—You get upon a drift of the London clay.

5625. Is your objection to reservoirs above in consequence of their being in the chalk formation ?—It was proposed to raise the water in the valleys to a height above the margin of the clay, that is, to where the chalk was exposed, so that the water would be absorbed by the chalk, and of course drop down to the subterranean level of the water in the chalk—that was my objection at that time. The cost of the system of drainage as proposed up to Waltham, including the main sewer and its two branches, a reservoir at Barking creek, engines, and a pumping station, would be 252,000*l.*

5626. Did that include the main sewers ?—Yes ; and the reservoir, which was a costly item.

5627. No tributaries whatever ?—None whatever, but the whole drainage is so laid out as to intercept all the tributaries now existing, or which might exist in the subordinate drainage of places on either side, such as Tottenham, Edmonton, and part of Hornsey.

5628. You would divide the area of the Lee into three sections, utilize the upper part as the gathering ground for the rainfall, and the streams for carrying the water to a certain point; you would form intercepting sewers to Bishop Stortford, to Ware, Hertford, and other towns, and carry the sewage from them to below Feilde's weir ; there you would utilize the sewage upon the land, and after irrigation pass it into the navigation below the point from which the water companies would draw their water ?—Yes.

5629. At the lower part, not being able to irrigate you would carry it in the low-level sewer to Barking creek, and there dispose of it in the same way as the Metropolitan Board would do ?—Yes.

5630. Do you know the valley sufficiently well to say whether there is land in the district between Tottenham and Feilde's weir that would be suitable and sufficient for irrigation ?—It is impossible I think to find a better site for irrigation than is to be found in the valley of the Lee, with this reservation, that there will always be amongst the residents on the sides of the valley objectors to any irrigation; but viewing the suburbs, and having due regard to the character of them, I believe that no place will be found where irrigation could be carried out less objectionably. With regard to the soil, I cannot call it a stiff clay, but it is a stiff loam, and it would require to be under-drained, both for the sake of purifying the sewage as well as benefitting the land when irrigated. There is every capability of doing it, owing to the rapid fall of the river itself when you get above Enfield marsh. The river, I think falls something like 5 feet in a mile, or between four or five, so that the drain has only to be carried a little more than a mile to discharge the water of drainage after the sewage has passed through the soil.

5631. (*Chairman.*) Have you any idea what area of marsh land there is to be found in the valley of the Lee and its tributaries above Stratford ?—I have not calculated that.

5632. You know that there are many thousands of acres of land now comparatively useless because it is water logged ?—It commands a good rent as it is, but it might command, if it were irrigated and drained, a very much larger rent.

5633. Does it command as much as 1*l.* per acre ?—It now lets, I should think, at someting like 50*s.* or 3*l.* an acre.

5634. (*Mr. Harrison.*) Looking at it apart from the value it has from its nearness to London, and looking at the intrinsic value of the land, is there not a large area in the valley which is capable of very great improvement ?—Very great subordinate improvement, were it provided with a sufficient outfall.

5635. An outfall of this kind would be the most efficient way of obtaining the improvement it requires, that is good drainage ?—There is no doubt that up to a certain point, say Enfield marsh, there is no other means of draining the land—I speak of from Barking creek to the lower end of Enfield marsh—but with a system of low-level lifting drainage. Above that you may drain the land by ordinary land drainage, and I believe that there is every capability of applying the sewage to irrigation.

5636. Do you not believe, looking at the Lee as a whole, that there should be a scheme proposed embracing all those points to be carried out as a whole throughout the river Lee rather than any partial work ?—My notion is decidedly what you express, and I only proposed a part rather than the whole because I considered that if we had the large figures that would be involved in so large a work it would not be entertained at all, and, therefore, my idea was at the time to limit the work to Waltham Abbey, but that what was done in such a way should be conformable to a more extended scheme hereafter. I would add, that in the plan that I proposed, which extended up to Waltham, I added to the works which I have already stated would cost 252,000*l.* intercepting sewers from the higher ground to lead the sewage to the lands which I propose to irrigate, and a further system of subordinate outfalls by which the irrigated lands would be drained into the river at a lower point, so as not to carry the water into the sewers, and the cost of that work would be 52,500*l.*, to which I added for the expense of lands and easements 20,000*l.*, making the total cost of the low-level system, in connexion with the interception of the high land sewage as far as Waltham, 324,500*l.*

5637. (*Chairman.*) Have you at all considered the rateable value of the property to be dealt with, and the rate in the pound per annum that it would take to pay the interest upon that money ?—I have calculated it, and I have stated it in the paper before you.

5638. With a view to getting rid of that burden would you prefer to pay it in 30 or 40 or 50 years ?—I recommended, particularly in this report, that it should be extended to 50 years.

5639. Would you propose to borrow a loan from the Exchequer Loan Commissioners at a low rate of interest ?—That was part of the scheme ; and the reason why I stated 50 years was, that the works were designed for prospective benefit rather than an immediate one, and, therefore, it was only just that the term should be lengthened one.

5640. (*Mr. Harrison.*) So as to let the property as it became improved pay for the improvement which had increased its value ?—Just so.

5641. (*Chairman.*) Have you entered into any question of profit and loss, taking the value of the lands to be dealt with now, and taking the probable improved value after dealing with them, and after the expenditure of the sum of money you have named ?—No. I looked upon the outfall as essential, not for the drainage

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B. Denton, Esq.

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of the land, but for the sewerage of the inhabited portion.

5642. Therefore it would be a matter the cost of which you could reasonably call upon the towns to meet, because they are now polluting the whole area by their sewage, and those works would enable them to sewer more completely, and not to commit an injury upon their neighbours?—Just so, and for another reason, that any improvement of land would not involve objectionable water, any discharge from the land being, under the present circumstances, a great improvement to the sewage discharged from the inhabited portions, there would be no objection to its being discharged into the river.

5643. (*Mr. Harrison.*) Are you going to appear before Parliament with a scheme in connexion with Tottenham and other towns?—At the present moment we are at a standstill; plans were prepared for deposit and they were deposited. Notices were given, and the parishes had a meeting at which they determined to do nothing, but consider it further on the ground that if through any report emanating from this Commission, or from compulsion, they were bound to combine in the general outfall, that Parliament would suspend the standing orders, and give them the power of doing so. Therefore, the result of the meeting of the parishes was to suspend our proceedings, and the consequence has been that the original scheme for the Ham marshes has been sunk in the indifference of the parishes to their present emergency.

5644. (*Chairman.*) We may assume that this inquiry has rather retarded than facilitated your operations so far?—It is so.

5645. (*Mr. Harrison.*) I suppose the result of our inquiry, if it ended in a more general scheme, would be beneficial?—It would exactly fit my notion of what ought to be done. I should mention, passing from the low-level drainage to the highest part of the district, that in my practice I have had to deal with two or three works which bear very closely upon the question before us, for instance, I have just finished the drainage of an estate immediately above Luton; it is but a small quantity of land, but there is a very large and constant discharge of water. The works have been in my hands something like 18 months, and I can speak with some certainty as to the large quantity of water that has been discharged from those lands. They are the property of Mr. Crawley, and the works consist of a system of under-drainage running up the valley here (*pointing to the plan*). The quantity of water delivered at that point I believe would go a great way towards supplying the whole of the town of Luton. I cannot state it positively, because I have never measured it; but I consider there is half a million of gallons discharged daily from that drainage area alone. I believe that the people of Luton are now considering some mode of pumping the water from the chalk, and the difference between that proposal and the utilization of Mr. Crawley's water would be, as we have seen in the Thames, that the pumping would draw the surface water down into the ground to be pumped up again.

5646. (*Chairman.*) Suppose you had to deal with the sewage of Luton, seeing that you have a choice of going up or down, the land being equally favourable both above and below, should you go up or down?—In the case of Luton I believe you have an exception to that which I consider the best plan generally, which is to go down and to discharge by gravitation. Here is an exceptional case, the ground round Luton is of an absorbent character, and would be very grateful for the sewage that might be spread over it; and the height of the hills is such that when the sewage penetrated them and found its level down into the soil, the water that could pass through the soil would return to the river in a pure state. I mean chemically pure as well as clarified.

5647. You think that there are exceptional circumstances at Luton that would induce you to irrigate the upper part of it rather than the lower?—Decidedly. Luton is surrounded by high lands of various characters, there is chalk, sand, and clay, and whatever sewage was pumped above Luton would, from the physical state of the country, pass into the soil and find its way ultimately into the springs without any injury to the river itself.

5648. If you could get an area of land sufficient to absorb all the sewage that you had, a couple of miles below, to which it could be conveyed by gravitation, might not that be cheaper than pumping it to the land above?—Yes, cheaper; but of course it would be disadvantageous to use that water after irrigation for domestic purposes. I have taken some pains, speaking only as one of the multitude interested in the question, to discover whether water, after passing through land or over land by irrigation, enters the river in a condition fit to drink, and the result of all the attention I have bestowed upon the point has been, that it is not fit to drink. Now, I do think, that Luton, standing at the head of the Lee system, might be compelled to pump its sewage to a height that should result in the passage of that sewage through a depth of soil which should lead to its discharge in a chemically pure condition into the river.

5649. Do you know what they do at Luton with their sewage now?—I do not.

5650. You do not know what it costs them to deal with it?—No.

5651. Do you know what the sewage consists of at Luton?—No, not precisely.

5652. You are not aware that there are tons of oxalic acid which go into the river every year after being used in bleaching the straw, and many tons of acids of different kinds, and sulphur, and in fact that there are exceedingly deleterious ingredients mixed to a large extent with the sewage of Luton, and coming from the neighbourhood of Luton?—Then I consider that an additional reason why the sewerage of Luton, if it is to be utilized at all, should be utilized in such a way as that the discharge should enter the river after every possible means had been taken to purify it. I do not think that any utilization of the sewage by irrigation in the valley can lead to the result we desire, which is a chemical purification of the water.

5653. (*Mr. Harrison.*) You think that its passage through a great depth of chalk or soil would so chemically purify it as to make it unobjectionable?—I do think so; but I do not speak from sufficient knowledge to be able to affirm it without some slight doubt, but it is very slight.

5654. (*Chairman.*) At present the authorities of Luton are compelled to filter the sewage of the town, and they are doing it at an annual expense of many hundreds, by a series of sediment beds. The sewage is treated by lime, and it is allowed to stand in open shallow reservoirs until deposition takes place, then the effluent water runs away into the Lee, and the mud is wheeled away?—Can anything be worse than that, except the simple discharge of the sewage at once into the river. Passing from Luton, which I referred to, because I consider it is one of the difficulties in utilizing the upper streams of the Lee, I will just mention another case on the Stort, showing the absolute necessity for strict supervision, and the necessity for complete interception of sewage water. I was called upon by one of the Courts to inquire into the discharge of sewage from some dog-kennels belonging to the Reverend Mr. Arkwright. He was master of the Essex hounds, and his dogs were dressed with arsenic, as I believe is the custom for mange and other skin diseases. The dogs were occasionally fed with glandered meat by accident, at any rate glandered horses had found their way to those dog-kennels. This was near the Stort, some six miles above its junction with the Lee. It was found that the drippings of horse flesh when glandered, and the arsenic from the washing of the dogs, found their way into Harlow brook and poisoned the horses that drank out of the brook. The consequence was that Baroness North brought an action against Mr. Arkwright for the damage that her tenants had suffered, and particularly one Mr. Barnard, and the Court ruled that the practice should be discontinued, and I was called upon

to see whether the discontinuance was perfect. Mr. Arkwright, finding that the Court had given this order, adopted various plans of purification and filtration, and even irrigation also; Dr. Voelcker, at my instigation, accompanied me to the spot and obtained some of the water and analysed it; although perfectly clear to the eye, and so satisfactory to all appearance, that I was very nearly drinking some of it, it was found on analysis to be as chemically impure as ever. Again, to convey to you what information I possess with regard to another tributary of the Lee, viz., the Mimram, I may state that I have just devised a scheme for draining the small town of Welwyn, and there there is no mode that I can see of dealing with the sewage, except by filtration, and discharging it into the river lower down, the difficulty being that it is not a town sufficiently large to warrant any expensive works, and the consequence is that without some very rigid rules as to the interception of the sewage, and conveying it down to a distance where it could be used for irrigation, I at present see no means of carrying out that drainage satisfactorily.

5654*a*. (*Mr. Harrison.*) Can you tell us the area of the upper portion of the river Lee which you have marked above Feilde's weir?—I cannot.

5655. Do you know the population of that area?—I do not.

5656. The principal towns are Luton, Hertford, Ware, and Bishop Stortford; what others are there?—There is Hoddesdon and Harlow and Sawbridgeworth; but there would be no difficulty in intercepting the irrigated sewage from Bishop Stortford to Feilde's weir, nor from Feilde's weir to Hatfield, though it might be considered best to lift the sewage and apply it at a high level.

5657. It is your proposition that Luton and Welwyn and other towns and villages similarly situated should be obliged to pump their water on to a high level, so as to purify it before it passes into the Lee?—I mentioned Luton as being a town where some special mode of arrangement should be adopted; as to Welwyn, I mentioned that merely as illustrating one of the many difficulties there are in dealing with these cases, but it is not an insuperable one. If a system of interception was generally carried out, that is, by combination, there would be no difficulty in dealing with it; but to deal with Welwyn without combination, certainly it would be too small, and in a very difficult position. Reverting to the question of storing water, there is no doubt whatever that if proper storage reservoirs are constructed there is no difficulty. I know I am speaking in the presence of those who appreciate it, and I do not hesitate to say, from a long acquaintance with valley drainage, and of the soil which exists in those valleys, that many places might be selected for the construction of reservoirs. I remember very well investigating the plan which was proposed by Mr. Rendel, and being struck with one reservoir which was to be made in Lord Salisbury's park, at Hatfield, I have noticed since a capability that exists in several parks to carry out what Lord Salisbury would have been glad to have seen carried out there. I refer to Pansanger, where there is a capability of storage, and to Brochet, Luton Hoo, and Welwyn Hoo, though there would be objections by some owners to drawing down the water. Again on the Rib near Wade's mill, and above Thundridge, I believe, there is a capability of constructing reservoirs, but, as I said before, they would have to be specially constructed, partly in the ground, and partly above; but not in connexion with those porous grounds which would allow of the escape of the water as fast as it got in.

5658. What was the extent of the reservoir that you proposed below Feilde's weir?—I took 610 acres as that which I considered would allow of a reservoir being made to hold a reserve of 20,000,000 gallons a day for 182 days, that is assuming the mean depth to be 22 feet.

5659. Have you gone into the probable expense of that reservoir?—No; not with sufficient accuracy to mention it; but I should tell you that looking at that, occupying 610 acres, and extending the supplemental reservoirs on the tributaries to 300 acres, and allowing 100 acres for banks and spoil, I considered that the whole would be done for half a million of money, exclusive of the cost of the covered conduit to bring the water down to the pumping stations.

5660. What volume of water have you calculated you could impound in the upper reservoirs?—Half as much more, making 30,000,000 gallons, in addition to that which is now obtained by the East London and New River Companies.

5661. Is there any other point upon which you wish to give us information?—I should certainly like to add, by way of explanation, that in the scheme which I have endeavoured to explain to you, we have made the extent of area tributary to the river Lee after irrigation, and after the water has been clarified by it, as large as possible and that of the low-level district as small as possible. I do not know whether you have observed it, but it is a very interesting feature in the consideration of this subject, that the New River expresses a tangible contour line to illustrate this division. You will find here (*pointing to the plan*) that it is 100 feet above Ordnance datum; it rises up a little, very imperceptibly, about 1 in 10,000, and you cut off that land (*pointing to the plan*) which can be made subservient to an irrigating system. I just observe upon that ot show the extent of land which might be made tributary to a system of irrigation on the Lee; of course it would extend lower than the New River as it approaches nearer to the place of distribution; but that line (*pointing to the plan*) conveys to the mind a very clear line of demarcation. Again, let me observe, as to a point upon which perhaps I was not explicit enough that with regard to the intercepting drains which I should propose as a means of keeping the river above Feilde's weir pure enough to drink, they would be open drains. I should not propose any covered drains where irrigation clarified the sewage, or else the expense would be very greatly increased.

5662. Would you take the sewage of Hertford, Ware, Hoddesdon, and the sewage of Stortford down the valley of the Stort in an open drain?—In open cuts after irrigation.

5663. You propose to take the sewage of Hertford, Ware, and Bishop Stortford and other towns to this mid-area, and there apply it?—Yes.

5664. Then until it arrived at Feilde's weir, you would carry it, in a close sewer?—No. I have not explained myself upon that point. I am assuming that the sewage of those various towns and villages would be applied for irrigation as it passed on its way towards Feilde's weir; if it were not purified by any system of irrigation, I am not prepared to say but that a covered conduit would be better than an open one.

5665. You would apply the sewage of Hertford, Ware, Bishop Stortford, and all the villages and towns on the river Lee and its tributaries, to land in the most convenient places adjoining to those towns; but you would intercept the effluent water from the irrigated fields, and carry it down in open ditches to below Feilde's weir?—That is precisely what I meant.

5666. Where it might be applied to the land, or be passed into the navigation?—That is the plan. If there were places where the sewage could not be used for irrigation, I cannot say at this moment that it would be better to convey it by a covered channel than an open one. The object would be to keep the cost of the works as low as possible.

5667. Is there any other point that you wish to mention?—Mr. Rogers Field, who is here, has taken some pains in getting out details, but perhaps they will be surplusage at this moment; he is perfectly willing and able to answer any question as to the way in which the quantity of sewage that we propose to discharge at Barking creek has been arrived at, and the details of the cost, if you wish to examine him upon it.

The witness withdrew.

LONDON.

B. Denton, Esq.

4 Feb. 1867.

The witness subsequently forwarded to the Commission the following letter:

22, Whitehall Place, London, S.W.,
April 16th, 1867.

GENTLEMEN,

MR. BAZALGETTE has addressed a report to a committee of several parishes on the river Lee in which he says that the sewage of the whole valley, including East and West Ham and Leytonstone, as shown by colour on a map appended to his report "can be conveyed by "gravitation to Barking," and that "no portion" of the district between Hertford and Stratford is suited for irrigation by sewage.

As this is in direct contradiction to the evidence given before your Commission on the 4th February last by Mr. Field and myself, I am desirous of an opportunity of placing before you, if it be not too late, proofs of the accuracy of the statement then made, and of the plan and section submitted to you upon which was based a proposal to form a drainage district of the whole valley, to comprehend a low level in conjunction with a high level system of works and lifting of a portion of the sewage.

You will observe in Mr. Bazalgette's report, that he proposes to remove the whole of the sewer of the Lee Valley to Barking Creek, there to be either utilised by the Essex Reclamation Company or discharged into the Thames, by both of which modes of disposal the water containing the sewage will be lost to the navigation and mills of the Lee.

It is unnecessary for me to remind you that, if the benefits of irrigation shall turn out to be greater than the cost of lifting, the sewage will be readily utilized by agriculturists on the high grounds within the Lee watershed with the twofold advantage of fertilizing the district from which it is derived, while helping to maintain the river system by the return of the effluent water after utilization. I think too it is equally unnecessary to point out to you that there are many reaches of low land on the sides of the Lee to which sewage may be applied with advantage by gravitation, owing to the rapid fall of the river (see section) which will afford a ready means of underdraining the lands to which the sewage may be applied. By removing the sewage of the Lee valley to Barking Creek on the other hand, and delivering it over to the Essex Reclamation Company for application, no part of that sewage can be applied to land without lifting, mixed as it will be with the sewage from Tottenham which can only be discharged at a lower level than the surface of the land.

Should your Commission be unable to hear me in further explanation of the data upon which my evidence was based owing to the time that has elapsed since I gave it, I have to beg you will allow this letter to appear in the appendix of your report as a reiteration of the following conclusions:—First, that it is utterly impossible to form a district of the whole of the Lee valley, the drainage of which shall be discharged by gravitation at all times of tide; next, that the sewage of Tottenham itself cannot be wholly discharged above high tide without recourse to mechanical agency; and last, that there are special capabilities in the upper part of the Lee basin for the utilization of the sewage of the different towns discharging into the river profitably and without objection, if the river be placed under a proper conservancy, having due regard to drainage, water supply, navigation, and mill power.

I have, &c.,
(Signed) J. BAILEY DENTON.

To the Rivers Commissioners.

Mr. R. Field, C.E.

Mr. ROGERS FIELD, C.E., examined.

5668. (*Mr. Harrison.*) You have been engaged with Mr. Bailey Denton in devising this scheme of interception?—I have.

5669. Have you entered to a considerable extent into the particulars of that scheme?—I have.

5670. I see that one of the main drains on the fork passes the towns of Tottenham, Edmonton, Enfield, and other places?—Yes, at least provision is made in the scheme for the drainage of all these towns.

5671. Are you aware of the difficulties that those towns lie under at present, as to carrying out a complete system of sewerage?—I am.

5672. Are you aware that Tottenham is, at present, lying under an injunction not to extend its sewerage system, which it proposed to do; and Barnet, which is an extensive parish, has been discharging its sewage into a cut that was made by the East London Water Company?—Yes.

5673. An injunction has been obtained to prevent the authorities of Barnet from discharging any more sewage into that cut?—Yes, I am aware of that.

5674. Would this scheme that Mr. Bailey Denton has devised and explained to the Commissioners get over the difficulty in the case of Tottenham?—Entirely.

5675. Are the sewers sufficient to carry off the sewage from the extensive districts to the west of the Lee, in case it becomes covered with a dense population, such as appears to be growing rapidly upon it?—The sewers shown on the plan are calculated with reference to the population merely of the district that is distinguished here (*pointing to the plan*) as being the low-level; the sewage of the high-level district is intended to be utilized for irrigation, and the effluent water discharged by gravitation into the river Lee or navigation. I may explain, in reference to the principle upon which the sizes of the sewers were determined, that the population according to the census of 1861, of the low-level district extending from Enfield to Barking creek, may be taken at 68,000, and the present population will be about 94,000; the area is 26½ square miles.

5676. If that was built upon, and so densely populated as the parts now occupied by the poorer classes of London, what would be the population upon it?—We have allowed for a different density of population in different portions of the district; for instance, the first portion, consisting principally of East and West Ham parishes, contains an area of 10¾ square miles, with a population in 1861 of 41,000, and I have considered it might have eventually a population of 200,000. Going upwards, I consider the district would not be populated to anything like the same extent, and I have therefore taken about three times the population of 1861.

5677. Why should the district not be largely populated?—Because it is getting further away from London, and judging by the rate of increase that has already taken place in West Ham, the population has doubled itself in 10 years, in the parishes above it has only increased from 20 to 45 per cent. in 10 years.

5678. The lower part is nearer to the river and Victoria docks?—Yes; in calculating for the other portions I have allowed about three times the population of 1861, amounting in the gross to 280,000 for the entire low-level district, the present population being 94,000 on an area containing 26½ square miles.

5679. Have you any facts as to the area of land in the valley of the Lee which is applicable for irrigation? The intermediate district you calculate can be brought in and the sewage applied to the land; the population is an item of importance, and also the area of land to which the sewage could be applied?—The present population of the high-level district up to Waltham may be taken at 55,000.

5680. What is the prospective increase that you expect?—That point has not been gone into further than to ascertain that there were capabilities for irrigation for any probable increase of population. There is a long and wide tract of level land here (*pointing to the plan*) which would be available for irrigation. It is considered that it would not be advisable to irrigate below the point B at the upper end of Tottenham marsh; but there is a considerable extent of land from B to C, near Broxbourne, which might be available, and would give an ample area for irrigation, several thousand acres.

5681. Would that land be so close to dwellings, towns, and villages as to be a nuisance?—An ample area, I think, would be found here (*pointing to the plan*) that would be sufficiently distant from the villages, so that irrigation would be perfectly feasible; the populated parts are not nearer to the river than a mile.

5682. Are there any other points that you wish specially to explain?—I may explain as to the principle on which the works were designed, that it was considered advisable to make the sewers of sufficient capacity for the maximum volume that they

would eventually have to take, but that the engine and reservoir need at present only be constructed of a small size with reference to the population for the next 8 or 10 years, as they could be enlarged when required. The estimate therefore includes sewers calculated for the maximum population stated, and reservoirs and engines only for half the maximum population.

5683. (*Chairman.*) Do you remember what your engine power is to be?—The full engine power that would be required would be 370-horse, and we propose to provide, 200-horse power for the present.

5684. What would be the lift?—It would vary from 12½ to 30 feet; when the sewers were running full the lift would not exceed 24 feet, and the maximum power required is calculated for this lift.

5685. What volume of sewage would you have to lift for 24 hours, or for an hour?—The maximum flow, including rain, that would have to be lifted ultimately would be 8,000 cubic feet a minute, half of this, or 4,000 cubic feet per minute, is what we have provided for in the first instance.

5686. (*Mr. Harrison.*) This scheme is one just beyond the limits of the metropolitan district, and devised to carry out a general system of intercepting sewerage for the whole of the suburban districts of the metropolis that now drain into the Lee, and to which the system of irrigation cannot be applied?—Precisely. The low-level district has been confined strictly to those portions from which it was considered impracticable to utilize the sewage by means of irrigation. Of course the precise limits of this district could only be defined by an accurate survey, but they have been arrived at approximately for the purposes of calculation. I think another point on which you wished for information was the rateable value of the district. This is a little over 600,000*l.* for the entire district below Waltham, including both high and low level.

5687. What was the rateable value of all the lower portion?—I have not got that separately.

5688. Is this lower limit (*pointing to the plan*) the portion which you intend to rate for the execution of the works.

(*Mr. Bailey Denton.*) No, it extends to the whole of the tributary area from Waltham to Barking creek; for instance, we should bring in Hornsey, which lies immediately about the New River, which I have spoken of as giving a contour line, dividing that part of the district of which the sewage could be utilized from that which must go to the low level for discharge.

The witness withdrew.

Adjourned *sine die*.

Lee Valley and Ham Marshes Sewage.

Memorandum as to Data on which the Project is based.

The valley of the Lee from the Thames to Waltham Abbey was proposed to be divided into two districts, a Low-level District and a High-level District. The sewage from the Low-level District would be intercepted by a deep main sewer and branches which would convey the whole of the sewage of the district to Barking Creek, where it would be raised by steam power into a covered reservoir similar to the present one of the metropolitan Board of Works, thence to be discharged into the Thames, or dealt with in any other way in which the metropolitan sewage may eventually be treated. The sewage from the High-level District on the other hand would be used for irrigation, and for this purpose would be intercepted by a series of main sewers and conveyed to various points on the meadows adjoining the Lee, the effluent water being discharged by gravitation into the river or navigation.

The following observations refer only to the Low-level District:—

Area and Population of Low-level District.

Names of Parishes.	Area within District.	Approximate Population within District.		Increase per cent.	Approximate present Population.	Prospective Population provided for.
		1851.	1861.			
	Square Miles.					
Woolwich, Barking, East and West Ham.	10¾	20,367	40,596	99	61,000	200,000
Leyton and Wanstead.	3½	4,400	5,500	25	6,500	16,000
Walthamstow and Chingford.	4½	3,300	4,800	45	6,000	14,000
Tottenham - -	5	8,000	11,600	45	14,500	34,000
Edmonton - -	2¾	4,500	5,400	20	6,000	16,000
Total - -	26½	40,567	67,896	—	94,000	280,000

Sewage provided for.

The volume of sewage is taken at five cubic feet per head per diem, and it is assumed that half this amount will flow off in six hours, giving a maximum flow of double the average daily flow.

Rain provided for.

The amount of rain provided for varies with the nature of the districts. In the Stratford and Ham Districts, which are for the most part below the level of high water, provision is made in the sewers for a quarter of an inch of rain *flowing off the ground* in the 24 hours, and it is assumed that the whole of the area capable of being built upon will be populated. In the districts above Stratford it is assumed that the rainfall will, to a considerable extent, be discharged into the river by the natural channels, independently of the sewers, and that storm overflows will be constructed in connexion with the sewers, so that only one eighth of an inch of rainflow per diem is provided for, and a deduction is made from the whole area for the portions it is considered will not be populated.

The table on p. 192. gives the details of the prospective population, sewage, and rainflow provided for in the different districts, and the calculated diameter of circular sewers capable when running full of discharging such sewage and rainflow. The sewers provided for in the estimate are somewhat larger than the sizes given by calculation, and an allowance is made for their being, where desirable, egg-shaped instead of circular. There would of course be intermediate changes of dimension between the points specified in the table, so as to graduate the sewers to the work they have to perform.

Engine Power required.

The maximum prospective sewage and rainflow is 7,941, or say 8,000 cubic feet per minute. The lift will vary from 12½ to 30 feet, but the maximum lift will not occur at times of maximum flow, when the main sewer is running full, which it will be at times of maximum flow; the lift (to the top water of the reservoir) will not exceed 24 feet. The engines must therefore eventually be capable of raising 8,000 cubic feet per minute, 24 feet high, or an aggregate power will be required of (say) 370 HP. It is proposed in the first instance to provide 200 HP.

Reservoir.

Assuming that the reservoir must be capable of holding six hours maximum flow of sewage and rainfall (which exceeds the provision made in the metropolitan reservoirs), a capacity will eventually be required of 2,880,000, or say 3,000,000 cubic feet. It is proposed in the first instance to provide a reservoir of one-half this capacity, or 1,500,000 cubic feet.

(Signed) Rogers Field,
6, Cannon Row, Westminster,
March 15th 1867.

Description of separate Districts drained by various portions of proposed Sewers.	Area of Districts.		Prospective Population.		Maximum flow of Sewage from prospective Population.		Rainflow.				Sum of maximum Sewage and Rainflow.		Conditions of Sewer capable of discharging maximum Sewage and Rainflow from accumulated Districts.	
							Separate Districts.			Accumulated Districts.				
	Separate Districts.	Accumulated Districts.	Separate Districts.	Accumulated Districts.	Separate Districts.	Accumulated Districts.	Area provided for.	Depth of Rain flowing off per Diem.	Flow per Minute.	Flow per Minute.	Separate Districts.	Accumulated Districts.	Fall per Mile.	Calculated Diameter of Sewer (circular).
	Sq. Miles.	Sq. Miles.			Cub. Feet per Min.	Cub. Feet per Min.	Sq. Miles.	Inches.	Cub. Feet.	Cub. Feet.	Cub. Feet.	Cub. Feet.	Feet.	Feet. In.
EAST BRANCH:														
District draining above junction with main sewer (near Copper Mills).	3¼	3¾	14,000	14,000	97	97	2	⅛	403	403	500	500	5	2 3
WEST BRANCH:														
District draining above Edmonton and Tottenham Parish Boundary.	2¼	2¾	16,000	16,000	111	111	2	⅛	403	403	514	514	5	2 3
Additional district draining above the crossing of the River Lee.	5	7¾	34,000	50,000	236	347	4½	⅛	856	1,259	1,092	1,606	5	3 7
MAIN SEWER:														
District draining at junction of East and West Branches.	—	11½	—	64,000	—	444	—	—	—	1,662	—	2,106	3	4 4
Additional district draining above crossing of Great Eastern Railway, (main line).	5½	17	25,000	89,000	174	618	5	¼	1,008	2,670	1,182	3,288	3	5 3
Additional district draining above crossing of Barking Road (including Plaistow.)	4	21	100,000	189,000	694	1,312	3½	¼	1,412	4,082	2,106	5,394	2	6 11
Additional district draining above outlet of main sewer.	5½	26½	91,000	280,000	631	1,943	4¾	¼	1,916	5,998	2,547	7,941	2	8 0

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II. Right to abstract water of Lee.
III. Point of intake.
IV. Pollution of river above intake.
V. Treatment of water.
VI. Quantity and quality of water.
VII. Distribution.
VIII. Miscellaneous particulars.
IX. Supply during outbreak of cholera in 1866.

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II. Right to abstract water of Lee:
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VIII. Miscellaneous particulars.
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IX. Supply during outbreak of cholera in 1866.
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EDMONTON:
Witnesses examined,
Chairman of Local Board, Mr. Busk, 3710–94.
Surveyor to Local Board, Mr. Gosset, 3795–854.
Population about 10,000, 3777. Health fair, 3743. SEWERAGE, none but a few short sewers, 3800–2. Not more than 200 waterclosets, 3813. CESSPITS usual, cleaned out by occupiers, 3742–4, 3776; cost, 3828–48; cost to community, 3751. Local Board are being sued by Tottenham Local Board for a nuisance, 3543; are suing Tottenham Local Board for the nuisance of Wood Green sewage, which the Lee trustees will not suffer to be added to Tottenham sewage passing into Lee 3778; are suing Colney Hatch Lunatic Asylum for fouling brook, 3717, 3738–40; have been at litigation with Enfield for a like reason, 3741. WATER SUPPLY, partly from New River, partly by private wells, 3746–51, 3820–4. Water of wells ochrey, 3748; according to analysis not bad, 3849; is it liable to infiltration from cesspools dug in same gravelly subsoil? 3533–7, 3785–6.

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Witness examined:
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G.

GARRATT, Mr. (of Stortford):
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GEE, Mr. (of Stortford):
Evidence of, 2627–705.

GEOLOGICAL:
Character of basin down to Cheshunt mostly chalk, covered in the valley by beds of sand, gravel, drift, and clay, and in some places patches of boulders, 480, 518, 680–3, 1490–1, 1841–51. Bed of Lee a natural filter. 683, 799–800, 808–11; but at lower end of Stort valley clay, 502–3; and at Broxbourne London clay begins, 693; at Tottenham a bed of gravel over London clay, but only at bottom of valley, 3500, 3514–21, 3524–9.

GLASS, Mr. (Traffic Manager of Lee Trust):
Evidence of, 4733–830.

GLASSCOCK, Mr. (of Stortford):
Evidence of, 2125–248.

GOSSET, Mr. (of Edmonton):
Evidence of, 3795–854.

GREAVES, Mr. (Engineer to East London Waterworks Company):
Evidence of, 66–658; 916–1049.

GRINDLE, Mr. (of Hertford):
Evidence of, 4970–5017.

GUY, Mr. (of Tottenham):
Evidence of, 3556–676.

H.

HAGGAR, Mr. (of Hertford):
Evidence of, 4894–969.

HALL, Mr. (of Tottenham):
Evidence of, 3236*–86*.

HATFIELD:
Sewage, led formerly into a chalk-pit, now into dumb wells, 4586–8.

HAWKES, Mr. (of Stortford):
Evidence of, 2890–924.

HEATH, Mr. (of Tottenham):
Evidence of 3287*–3363.

HERTFORD:
Witnesses examined.
Mayor, Mr. Armstrong, 4176–249.
Town Clerk, Mr. Longmore, 4250–328.
Inspector of Nuisances, Mr. Jarrett, 4654–97.
Surveyor to Corporation, Mr. Wilds, 4698–729.
Manager of Sewage Outworks, Mr. Grindle, 4970–5017.
Mr. Haggar, Seedcrusher, 4894–969.
Mr. Pollard, 5018–21.
Population about 7000, 522: 1069. Local Government under special Acts 4187. Trade, Oil Mills 4190. SEWERAGE: under Hertford Sewage Act of 1854. New River Company has constructed a main sewer intercepting all drainage from river; with this main sewer Corporation has nothing to do except to make connecting house-drains with it, and New River Company has nothing to do with house-drains; neither sewer nor house-drains ventilated; hence bad smell; 1078–82, 4292–308, 4660–1, 4720–1, 5001–17. Outlet of Sewer below intake of New River Company from Lee 1078–82; 4258–64. SEWAGE, before discharge, is dealt with by Higgs' process of precipitation by lime, chloride of lime being added, 1170, solid matter taken out and sold, but fetches a small price, 3766–8, 4972–7, 4992 effluent water discharged into Lee, 4258–64. Sewage much diluted from spring water in sewers, **1083–4**; **2977**. But sewer-outlet very foul, 4401, 4404–8. Effects of pollution felt at Ware, 4407, 5138–41, 5208; at Stanstead, 2303–4. Total outlay by New River Company upon sewer and outlet works, 22,000*l*, annual expense 600*l*. 1312, 4986–92. WATER SUPPLY, two sources both in hands of Corporation, one from Lee above town, the other from well in Hartam, also private wells, 4204–11, 4265–87, 4319–28. Quality, 4200; **4328–9** [PAPER,] 5018–21. Volume, equivalent to 30 or 40 gallons per head of population supplied; gross waste, 4666–97.

HIGGINS, Mr. (of Luton):
Evidence of, 1931–46.

HITCH, Mr. (of Ware):
Evidence of, 5240–329.

HODDESDON:
See evidence of Mr. Manser, 4831–93. Population, 1898, 523. Sewage partially carried out into river, 4430.

HUNT, Mr. (of Stortford):
Evidence of, 2249–2345.

I.

IRONSIDE, Mr. (Surveyor to Enfield Local Board):
Evidence of, 3855–949.

J.

JARRETT, Mr. (of Hertford):
Evidence of, 4654–97.

K.

KNIGHT, Mr. (of Mile End):
Evidence of, 3116–335.

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L.

LEE RIVER:
Acts concerning 532–3 *Paper*. Area of basin, 500 square miles, 481. Population of basin down to Hackney exclusive of Hackney and Walthamstow, 174,000, 611–2. Geological character of basin, see *Geological*. Source in a series of springs at Leager Marsh two or three miles from Luton, 1820–4. Height of range of Watershed, 801. Essentially a spring-fed river, springs rising in bed, 684–699, 802, 3049. Liable to be flooded; see *Flooding*. Clears itself very quickly after flood, **816–8**. Tributaries, **532–3** [PAPER.] A Tida- river; extreme point of tide Lee Bridge Mills, five miles from Thames, 86, 725–6. A navigable river, see *Navigation*. Volume of, as gauged at Fielde's Weir at junction of Stort, 702–8, 804–7, as estimated at intake of New River Company, **816–8**. Appropriation of water, see *Navigation; East London Waterworks Company; New River Company*; total volume daily abstracted 43,300,000 gallons from rivers with basin of 450–500 square miles, as compared with 48,375,000 gallons daily taken from Thames basin of 3,500 square miles, 1027–32. Mills upon, see *Mills*. Pollution of, see *Pollution*. Conservancy required for, see *Conservancy*.

LEE RIVER TRUST:
See *Navigation*.

LEGISLATION:
For River Lee, see *Conservancy*.

LIMEHOUSE CUT:
An open cesspool, 843–7.

LITIGATION:
To prevent pollution of rivers and streams.
Edmonton *v.* Colney Hatch, 3717, 3738–40.
,, *v.* Enfield, 3741, 3905–7.
,, *v.* Tottenham, 3543.
Lee Trustees *v.* Metropolitan Board, 4469.
,, *v.* Tottenham, 3263–5, 3280–1, 3303–11, 4451, 4458.
Leigh - *v.* Luton, 1604–14.
Tottenham *v.* Hornsey Board, 3360, 4453.

LONGMORE, Mr. (of Hertford):
Evidence of, 4250–328.

LUTON:
Witnesses examined:
Chairman of Local Board, Mr. Pledge, 1367–419.
Surveyor of Local Board, Mr. Sandoe, 1420–600, 1684–717.
Clerk of Local Board, Mr Bailey, 1601–43.
Officer of Health, Mr. Kit Tomson, 1644–83.
Member of Local Board, Mr. Davis, 2021–46.
Local Registrar and Sanitary Inspector of Board of Guardians in hamlet, Mr. Maffey, 1870–930.
Mr. Willis, straw hat manufacturer, 1718–806.
Mr. Higgins, straw plait merchant, 1931–46.
Mr. Lye, straw plait dyer, 1969–2020.
Mr. Taylor, Bailiff to Mr. Crawley, 1947–68.
Largest town in Watershed of Lee, 477. Population nearly 20,000, 478, 1069, 1371; and fast increasing, 1372, 2021–32. Rateable value, 40,000*l.*, 1373. Health improving, 1409, 1682, 1870–930. SEWERAGE; all houses drained in township, 1421–33; only intercepting sewer ventilated, 1430–1, 1591–5; evil effects of no ventilation, **1676**, 1709. Drains cannot be flushed, but are kept tolerably clear by abundance of subsoil water, and water from dye-houses, 1578–91, 1695; and the fall is good, 1694. Sewers carried under river, as town is on both sides, 1497–9; not liable now to be flooded, as storm-water bed has been made, 1701. SEWAGE from sewers is discharged into river, after treatment by Higg's process; this treatment ordered by injunction procured by neighbouring landlord, 1074–5, 1604–14. Volume of sewage, 1000; contents of 500 waterclosets, 1434–9; outlet discharge about 240 gallons per minute, but great portion of this is spring water which has found its way into sewers, 1457. Sewage first led into settling beds below town, there lime and chloride of lime applied, and liquid allowed to evaporate, 1523–7, 1534–46; sewage then pumped in semi-solid state across the river; when dry, bought by farmers, 1465–6; formerly difficult to dispose of, from 2,000 to 3,000 square yards having been on hand, 1471–7; more than 2,000 tons of solid matter thus annually taken out of depositing tanks, much of it road grit, 1461–70. Original outlay upon sewer and works nearly 15,000*l.*, 1478–9. Annual expense nearly 500*l.*, 1451–6. WATERCLOSETS supplied only by pumps and rain-water, 1434–9; inconvenience of want of water very great, 1743–8. PRIVIES usual amongst poor, 2,000 or 3,000, near to houses, 1503–12. Cesspits, made in chalk, 1513–22; some emptied under directions of Local Board, 1440–9; others not emptied at all, **1921-30**. WATER SUPPLY, deficient and unwholesome; no public supply, but 1200 wells, 1376; in a dry summer half of these become dry, 1671; wells liable to infiltration from cesspits, 1513–22, 1921–30, 1907–8; probably not from sewers, 1678–80, 1696–700. Want of water cause of ill health, **1654–76**; in dry summer of 1864 death-rate rose to 35 in a thousand, 1889. Proper supply needed also for use of waterclosets made and to be made, and for bleaching purposes, 1743–8. Abundance of water in district, 1618–24, 5645. Trade, straw plait. Pollutions from dyeing and bleaching plait, see *Dyeing* and *Bleaching*. All refuse goes into intercepting sewer, 1401–2. SEWAGE IRRIGATION, land available below town, 1615–6, 1852–4; and above town, where soil more favourable, 5646–53. Outlying districts, no sewerage, 1907, 1919–30, 1944–6; no water supply, in time of drought people were reduced to drink out of ponds and out of river, **1891–901**.

LYE, Mr. (of Luton):
Evidence of, 1969–2020.

M.

MAFFEY, Mr. (of Luton):
Evidence of, 1870, 1930.

MALTINGS (pollution of river from):
Witnesses examined:
Mr. Barnard, of Bishop Stortford 2546–626.
Mr. Fairman, ,, ,, 2346–409.
Mr. Hawkes, ,, ,, 2890–924.
Mr. Miller, ,, ,, 2410–446.
Process of soaking barley, 2381–92, 2405–9; effluent water passed into sewers and thence into river, water is thick, 2393, 2400; and if left to stand would ferment, 2419–20; but is cause of little nuisance in the river, 2072–3, 2353–7, 2475–80; contains nothing mischievous to vegetation, and would improve sewage for irrigation, 2421–2, 2480. Malting trade increasing at Stortford, 2349–52, 2361–4; at Ware, 5033, 5055–60.

MANSER, Mr. (of Hoddesdon):
Evidence of, 4831–93.

MANUFACTURING REFUSE:
Pollution of rivers from. See *Bleaching, Dyeing, Malting*. Mills on Lee, corn and oil mills, except Government mills at Enfield, 756–8; mills on tributaries of Lee, corn mills, except one small paper mill at Luton, 760.

MARCHANT, Mr. (of Hertford):
Evidence of, 4329–501, 5564–70.

MARSHALL, Mr. (of Tottenham):
Evidence of, 3364–555.

MARSHALL, Mr. (of West Ham):
Evidence of, 4016–118.

MILE END:
See evidence of Mr. Knight, surveyor to vestry, 3116–335. Infiltration of wells from cesspits, 3190–213.

MILLER, Mr. (of Stortford):
Evidence of, 2410–46.

MILLS:
(1.) Number of, on Lee above Hertford 12, 2621; below Hertford, ; on Mimram, 8, 2618; on Stort, 2818–20.
(2.) Discontinuance of; water power superseded by steam, 2466–7; and itself from various causes diminishing, 2316. 2319. See *Water Supply*.
(3.) Pollution from, very little. All mills on Lee, except Government mills at Enfield, are corn or oil mills, 756–8; but other mills are being started below Enfield, 792–4; mills on tributaries of Lee are corn-mills except one small paper mill at Luton, 760. All mills on Lee between Ware and Lee Bridge (except Government mills and one mill at Broxbourne) belong to Lee trustees, or to one or other of the two water companies, 756.

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(4.) Right of, to take water. On Lee no difficulty, the Lee Trust having a paramount statutory right to water for navigation, 4501–2 [Appendix No. 1]. On Stort occasional difficulty between millers and Navigation Company, but mills have superior vested right, 2803–5, 2813–5.

(5.) Floodings occasioned by. Some mills not equal in value to the damage they inflict, **2581–86, 2618,** 5421–9. With proper arrangements mill-power may not be diminished, and all flooding prevented, 5580.

MIMRAM:
The purest stream that flows into London, 686–8, 2617; but polluted by sewage at Whitwell and Welwyn, 2617–8; and by tanyard, 5338. Never overflows its banks, 5338; unless ponded up by mill-weirs which cause great mischief, 2616–8.

MUIR, Mr., Engineer of New River Company:
Evidence of, 1050–366.

N.

NAVIGATION:
I. Of Stort.
Witness examined,
Surveyor of Navigation, Mr. Davis, 2767–889.
Established by statute, 2791; now property of a private firm, 2776–9. The firm do not carry goods, only maintain navigation, 2833. Length of, 2768–71; locks, traffic, and tonnage of boats, 2772–5. Usual draught of water, 2837. Power to dredge, 2792–4. Power to prevent pollution insufficient, **2790, 2806–11, 2888–9.** Right to take water subject to that of mills, 2802–5, 2814. Lock dues, 2863–75. Waste of water in use of locks, 5340–1. Commissioners appointed under Act have died out and their places have not been renewed; want of authority felt, 5340.

II. Of Lee, by Lee River Trust.
Witnesses examined,
Chairman of Trust, Marquis of Salisbury, 4502–653.
Clerk, Mr. Marchant, 4329–501, 5564–70.
Engineer, Mr. Beardmore, 659–915.
Traffic manager, Mr. Glass, 4730–830.
Mr. Manser, 4831–4893.
1. Constitution of Trust.
2. Powers of Trustees.
3. Extent and course of Navigation.
4. Extent and value of Traffic.
5. Financial condition of Trust.

1. Constitution of trust, fixed by statute; now an incorporated body with power to acquire land, **4501–2** [Appendix No. 1]. Trustees, 67 in number, consisting of (*a*) ex-officio members, viz., Mayor and Corporation of London, members of Parliament for certain counties and boroughs, officers of New River Company, and others, 4335, **4501–2** [Appendix No. 1], 4555; and (*b*) of members with property qualification chosen by the Trust, chiefly riparian owners, 889–90, 4557, 4865. All unpaid, 866–8. Some objection felt outside that few business men are elected to the Trust, and that there is no appeal from the Trust, 4866–4869, 5459–68.

2. Powers of Trustees. Ownership of bed of river, 750. Paramount right to fixed volume for navigation, and of entire volume below Tottenham, 4501–2 [Appendix No. 1]. Obligation to execute works for water companies at the expense of the companies, 4489–90. Power to dredge, systematically used, 753; ballast sold and profit made, 4747–8; reaches have been deepened, 4889–92; canal carries barges of 100 tons instead of 40, 4878; in 15 years 160,000*l.* spent in improvements, 874. Power to scavenge exercised, 753. Power to stop casting in of rubbish, if injurious to navigation, 4384–93; but power to prevent pollution insufficient, 4535. Trustees send notices to prevent pollution, **4501–2** [Appendix No. 2]; refuse to grant wharf except upon condition that sewage is kept out, 4462–5; invoke intervention of Thames Conservators for lower part of Lee, 4393–4401. No power to look to drainage of valley, 769. No power over parts of river not used for navigation, 775.

3. Extent and course of navigation, **664,** 728; partly in river canalized, mainly in canals, 774–8. Locks, 20, 730; their construction, 738–42; draught and tonnage, 744. Barges drawn by horses, not by steam power, 745–7. Trustees not themselves carriers; only maintain navigation.

4. Traffic, extent of, **4372–3; 4501–2** [Appendices No. 3 and 4]; **4512–13** [Tables]; **4521** [Tables]; **4830–1** [Appendix No. 1]. Manure carried free, 4497. Rates, 4376–8; 4830–1 [Appendix No. 2]. Value of navigation to Hertford, 4309–18; Hoddesdon, 4843–4, 4849–50; Tottenham, 3547–54; to powder magazines, 4861; to health, 4492; to country at large, 5357–61.

5. Financial condition of Trust. Sources of income. Tolls and payments by water companies, rentals of mills, and sale ballast, 876–81, 966, 4501 [Appendices No. 1, 3, and 4]. Profit goes to diminish mortgage debt, 4340, 4358–70, 4379–82, 4483–8, 4615–30.

NEW RIVER COMPANY:
Witness examined.
Engineer to Company, Mr. Muir, 1050–366, 2976–3115, and 3115–6, [Paper].
I. Constitution.
II. Supply from Lee.
III. Other sources of supply.
IV. Treatment of water.
V. Quantity and quality of water.
VI. Distribution.
VII. Miscellaneous particulars.

I. Constitution.
By Acts of Parliament, 532–3 [Paper], 3115–6 [Paper]. Capital more than 3,000,000*l.* sterling, 3013–4; more about to be raised, 3115–6, Paper.

II. Supply from the Lee.
Right to abstract water fixed by Act of 1855, subject to right of navigation, but superior up to a certain point to right of East London Waterworks Company, 4501–2 [Appendix No. 1]. Payments to Lee Trust, 53,000*l.*, 3104–5, 876–81. Point of intake of water, Balance engine between Ware and Hertford, 473. Area of basin above intake, 244 square miles, 482. Population of basin above intake, **1069–73.** Pollution of Lee; by sewage from Luton, see *Luton;* by manufacturing refuse from Luton, see *Bleaching* and *Dyeing;* not by sewage of Hertford, which is intercepted by sewer constructed by company, see *Hertford.* Company has expended 30,000*l.* on sewerage works, 3109.

III. Other sources of supply.
Chadwell spring, and wells at Cheshunt, Amwell Hill; also, in reserve, wells at Amwell, Hampstead Road, Hampstead Heath, and Hoddesdon, 493–4, 1053–8, 1063, 1182–5, 3005, **3115–6** [Paper]. These give company a command over 35,000,000 of gallons daily, 1182–3. Volume actually used, 22,500,000 gallons, 1185. For non-domestic uses company has right to draw from ponds on Hampstead Heath, and from Thames below Blackfriars Bridge, 3115–6 [Paper].

IV. Treatment of water.
(1) Conduit. Water led to London by New River, a conduit 28 miles in length, 1288–320; carefully looked after, and protected from contamination, 3947–9, 1314–20.
(2) Store reservoirs, **3115–6** [Paper]. Area, 100 acres; capacity, 200,000,000 of gallons, 1103–16.
(3) Filter beds, 11½ acres, the medium being sand; not so large in proportion as those of the East London Waterworks, because water less turbid from flood and less polluted, 1112–24, **3115–6** [Paper]. Expense of charcoal filtration, 1125–37.
(4) Filtered water service reservoirs; capacity 20,000,000 gallons, 3115–6 [Paper].

V. Quantity and quality of water:
Volume supplied about 22,500,000 gallons daily, 1185. Quality, water pure, 1139–41, 2977, **3115–6** [Paper]; but hard, 1146–65; Dr. Clarke's process for softening expensive, and if it superseded filtration would cause deposit in pipes, 1175–81.

VI. Distribution:
Pumping arrangements, 3115–6 [Paper]. Area supplied, 1331–2; Tenements supplied, 111,958; houses, 3115–6 [Paper]. Most have waterclosets, 1186–8. 18,000,000 gallons pumped; 4,000,000 pass by gravitation, 1340. Supply equivalent to 30 gallons per head of population of district, 1339. Supply constant only to those who take proper precautions against waste, about 1200 in number, 1192–8, 1210–11, **3115–6** [Paper]. To others intermittent; on six days in the week for a time long enough to fill cisterns; and on Sunday, also in some poor districts (nearly 50,000 houses) where provision to receive water is bad, **3115–6** [Paper]. Arrangements by landlords to receive water miserably defective even for intermittent supply; and constant

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supply impracticable; poor very ill off for water, 1211–35, **3115–6** [Paper]. Much water wasted; 7 gallons a head really enough; the cistern system might be usefully extended, 3080–97. Maximum prices with many exceptions, 1199-201, 3115–6 [Paper]. The supply might be increased and improved if flood waters of river stored in reservoirs; if sewage were kept out; if water economised, and filtered water not wasted in watering streets, 3008–21, 3099–102.

VII. Miscellaneous particulars :
Water for fire extinction supplied gratuitously; also cheap plug, but not expensive hydrants, 1203–4, **3115–6** [Paper]. Head of water, 1280–7. Water rarely injured by proximity of gas-pipe, 1257–8, 3062–77. Complaint book, 3032–3.

O.

Old Ford :
Pestiferous from discharge of manufactories, &c., 4462. Outfall of works of Metropolitan Board, 469–4482.

P.

Parker, Mr. (of Ware) :
Evidence of, 5343–485.

Perry, Mr. (of Stortford) :
Evidence of, 2925–75.

Phillips, Mr. (of Tottenham) :
Evidence of, 4141–60.

Pledge, Mr. (of Luton) :
Evidence of, 1367–419.

Pollard, Mr. (of Hertford) :
Evidence of, 5018–21.

Pollution of Lee :
A. Above intake of New River Company.
By sewage, and bleaching and dyeing refuse from Luton, see *Luton, Bleaching, Dyeing*. By privies at Welwyn and Whitwell on Mimram, 2617–8, 5654–7. By sheepwashings, 5332–6.
B. Between intake of New River Company and intake of East London Waterworks Company.
By sewage of Hertford, see *Hertford;* of Ware, see *Ware;* of towns on Stort, see *Stortford*, 655; and by Maltings, see *Maltings*. Stort gets fouler and fouler, every house and farm drains into it; mud sludged out by millers, **2559–64**, 2571–5, 5654. By sewage of Hoddesdon, Broxbourne, Cheshunt, Waltham Abbey, Waltham Cross, 101, **514–28**, 655, 3337–9.
C. Between intake of East London Waterworks Company and Thames.
By sewage of Enfield, Ponder's End, Upper and Lower Edmonton, and part of Tottenham, which comprise 52,000 persons, intercepted in Catchwater Dyke made by East London Waterworks Company 612, 4501–2 [Appendix No. 1], 3266*, 3314*, 3465–71, 3666–9, 4443–6. By sewage of Tottenham, see *Tottenham*. Below Tottenham river very foul; from manufactories, 4751–2, 4768–9; from sewage of more thickly populated neighbourhood; Leighton, Leightonstone, Walthamstowe, 3555; Old Ford, 4462, 832–3; Metropolitan outfalls, 4469–82; West Ham, **4059**, see *West Ham*. Silvertown, **4067**; Limehouse cut, 843–7, **4501–2** [Appendix No. 1]; pollution increased by effects of tide, 826–8, 842–9, **923**, 1037–49, 4060–4.

Privies, see *Barnet, Edmonton, Luton, Mile End, Stortford, Tottenham, Ware, Welwyn.*

R.

Rainfall :
In east London district averages 26 inches in the year, 596, at Fielde's Weir, 700–1 [Paper].

Reservoirs :
For flood waters none, 531; scarcely possible in porous soil of upper Lee Valley, 3047–9; *secus*, in lower valley on London clay, 3050–3, 5623–5, 5657–60; recommended by Mr. Rendel, 5390–408.

Riparian Property :
Much of it unenclosed, might be improved by drainage and embankment, 783–91. See *Floodings*, and evidence of Mr. Taylor, 1947–68.

Road Scrapings :
Sold, 3579–80.

S.

Salisbury, Marquis of :
Evidence of, 4502–653.

Sandoe, Mr. (of Luton) :
Evidence of, 1420–600, 1684–717.

Sawbridgeworth :
Population of, 524.

Scavenging :
Done systematically by Lee Trustees, 753, 4926–8; not done on Stort, 2565–7, 2811.

Sewage :
Pollution by, see *Pollution, Litigation, Barnet, Colney Hatch, Edmonton, Enfield, Hertford, Hoddesdon, Luton Stortford, Tottenham, Ware, West Ham.* Irrigation with, see *Barnet, Colney Hatch, Luton, Stortford, Ware, West Ham.* Interception of, at the lower end of Lee Valley, **3450–75**, 3545–6, 3770, 5593–644, 5654*a*–667, 5668–88. Suggestion by Mr. Bailey Denton. For low level an intercepting sewer to Barking Creek, there to join metropolitan system or sewage to be treated like metropolitan sewage; for high level, irrigation, and delivery into Lee below intake of East London Waterworks Company. Scheme might be enlarged beyond Waltham Abbey, **5667–8** [*Paper*].

Sheep-washing :
Pollution of rivers from 5332–6.

Silvertown :
Not drained by West Ham Local Board, 673-5.

Solid Refuse :
Not much thrown into Lee: power of trustees to stop it, 763–72.

Straw Plait Manufacture :
Witnesses examined.
Mr. W. Willis, of Luton, 1718–806.
Mr. Higgins „ 1931–46.
Mr. Lye „ 1969–2020.
Trade more than a million sterling annually, 1801, 1935 half of population of Luton engaged in, 1750. Pollution of river from, see *Bleaching* and *Dyeing*.

Stort, Valley of :
Chalk overlaid with clay, 2090–3; the floodiest stream running to London, 2594: but in drought quickly falls off, 813–5, 2080–4. Pollution of, by sewage of Stortford, see *Stortford:* by refuse from dog-kennels, 5654: the river getting fouler and fouler: every house and farm drains into it: at Raydon mill the miller sludges mud down stream, **2559–75**. Navigation of, see *Navigation*, and evidence of Mr. Davis, 2767–889.

Stortford :
Witnesses examined.
Clerk to Board of Guardians, Mr. Taylor, 2047–124.
Surveyor to Highway Board, Mr. Glasscock, 2125–248.
Clerk „ „ Mr. Gee, 2627–705.
Surveyor of Stort Navigation, Mr. Davis, 2767–889.
Manager of Gasworks, Mr. Perry, 2925–75.
Mr. Hunt, mill owner, 2249–345.
Mr. Garratt, „ 2546–626, 5330–42.
Mr. Fairman, maltster, 2346–409.
Mr. Miller, „ 2410–46.
Mr. Barnard, „ 2447-545.
Mr. Hawkes, „ 2890–925.
Mr. Odams, „ 2706–66.
Population more than 5,000, not increasing, 2050–1, 524. Rateable value, 23,700*l.*, 225. Local Government Act just about to come into operation, 2059–62, 2499–500, 2634. Public health pretty good, 2063–4. Trade, malt, 2070. Sewerage nearly throughout town, but unsystematic, 2134–5; sewers not ventilated, **2153–8**; ill-constructed, have to be opened for a great length in order to be cleaned, 2144–52, 2433. Sewage from sewers discharged into river at seven outlets, 2136–8; river falls very low in summer and becomes very foul, **2203–23**, 2256–63, 2428–9, 2689–700, 2710–5, 2718–22, 2786–90, 2806–10, 2851–2, 2879a. Ill health caused by sewage deposit, 2450–5. Authorities flush

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sewage accumulations down stream by means of barge and rake, **2105–6**, 2460. Complaints made by people at Sawbridgeworth, 2103, 2495-6, 2661–6, and at Harlow, 2457. Waterclosets 300, supplied by water pumped up, 2141–3. Privies, some discharge into river, 2906–7, 2667–9. Ashpits cleansed once in the last seven years from fear of cholera, 2165–72. Cesspools common in houses which have access to sewers, 2233–4; 400 in number, 2141; generally in impervious stratum, 2161–4. Sewage Irrigation, 15 feet of fall within one and a half miles of town, 2437–46, 2481, 2716–7; land might be had, but liability of low land to flooding, a difficulty perhaps to be met by choosing a higher site and pumping, 2166–9, 2199–202. Water Supply from private pumps, but abundant, 2089, 2189–98; 2917–24.

T.

Tan:
Refuse on Mimram, 5338.

Taylor, Mr. (of Luton):
Evidence of, 1947–68.

Taylor, Mr. (of Stortford):
Evidence of, 2047–124.

Tomson, Mr. (of Luton):
Evidence of, 1644–83.

Tottenham:
Witnesses examined.
Chairman of Local Board, Mr. Hall, 3236*–286*.
Clerk, Mr. Heath, 3287*–3363.
Surveyor, Mr. Marshall, 3364–555, 3555–6, [Paper].
Inspector of Nuisances, Mr. Guy, 3556–676.
Registrar of Births, Mr. Ross, 4161–75.
Mr. Delano, 4119–40.
Mr. Phillips, 4141–60.
Population nearly 18,000. Area, 4,624 acres. Houses, 4,000. Rateable value, 91,000*l.*, 3555–6 [Paper]. Health improved by sewerage and sanitary works, 3242*–82*. Mortality, 3282*–6*. Sewerage, formerly only cesspools, discharging into Lee, 3292*–6*, 3561–4. Now sewerage constructed throughout one half of district, 3555–6 [Paper,] 3303*–6*. Sewers well flushed, but with no special ventilation, 3475–96. Wood Green district sewered, but sewers not used, 3280*–1*. Some cesspools in gravel in Page Green district, 3531–6. Sewage from about 2,000 waterclosets, 3408; of 7,000 to 10,000 persons, 3407; is subjected to liming process, then cast into River Lee, 3241*, 3276*–9*, 3401–2; process entirely fails to purify, 4447–60; outlet a nuisance by pollution to river, 3262*. Lee trustees have obtained an injunction against Tottenham Local Board adding sewage of Wood Green district to sewage of Tottenham proper, 3280*–1*, 3263*–5*, 3303*, 4458; consequently house drains of Wood Green not connected with sewer recently made, and cost of sewer, 9,000*l.*, thrown away, 3280*–1*; temporary cesspools made in Wood Green district, chiefly in clay, 3311*, 3522, 3618–21; and are a nuisance to Edmonton, 3778. About 4,000 waterclosets in parish, 3555–60 [Paper]. Higgs' process of treatment of sewage now disused; a commercial failure; works bought by Local Board for one fourth of prime cost, 3376–427. Now only lime used, 3646–63; about 100 tons per annum, 3395, 3405. Solid refuse sold at 2*s.* 6*d.* per ton, 339€–8, 3609–17; accumulated in large quantities, 3592–603. Annual cost of works to Local Board 130*l.*, 3413–23. **3555–6**, [Paper.] Sewage Irrigation, soil, marsh land and stiff clay; valuable, 3322*–5*. Irrigation tried for a while successfully on 40 acres, 3428–40; but prejudice against it, 3440–6; best plan, Tottenham sewerage to be merged in Metropolitan sewerage system, 3326*; or combined with other parishes, 3329*–31*, 3450–75; and sewage pumped into Essex, 3537–9. Nuisances in parish; Muswell River very filthy in summer from sewage of Wood Green and Hornsey 4144–60; and from drainage of cemetery, 4162–3. Catchwater Dyke, a ditch made by East London Waterworks Company, intercepting sewage from Ponders End and other villages passing through parish, and delivering into Lee, 3758–64, 3266*, 3314*, 3465–71, 3666–9, 4443–6. Discharge from works between outfall of Catchwater Dyke and Tottenham outfall; sewage from Edmonton, Enfield, &c., 3314*–7*, 3340–2. Water Supply; in hands of board partly from pumps, 3267*–75*; partly from land springs in gravel overlying clay, 3497–513, **3555–6** [Paper]. Water from gravel, hard, ochrey, and corrosive of iron pipes, causing leakage and short supply, 3677–709, **3555–6** [Paper]; liable to injury by infiltration of sewage from Edmonton cesspools, 3531–6; *secus* 3785–6. Wood Green district supplied by New River Company, 3275.

W.

Waltham Abbey:
Population 5,000, 522; sewage of, a nuisance, enters London above intake of East London Water Works, 4437–40.

Ware:
Witnesses examined.
Clerk to Local Board, Mr. Cobham, 5022-184.
Officer of Health, Mr. Butcher, 5285–239.
Surveyor, Mr. Hitch, 5240–329.
Inspector of Nuisances, Mr. Bond, 5486–536.
Mr. Parker, 5343–485.
Mr. Brown, mill owner, 5537–55.
Mr. Beningfield, auctioneer, 5556–63.
Population over 5,000, 522, 5024. Trade, malting, 5033, 5055–60. Sewerage; entire town underdrained. 5036; about 220 waterclosets, 5256; sewers not ventilated, but not complained of, 5272. Sewage of sewers passes into Lee by five outlets; net, except from dilution of spring water escaped from subsoil into sewers, 2305, 5038, 5255, 5290–4. Great nuisance at outfall, 3766, 4408–17, 4572, 4501–2 [Appendix No. 1]; *secus*, 5289. Privies also and drains discharged into river, 4428, 5308–13. Houses not having waterclosets, have cesspools, which are emptied by owners, 5069–77, 5295–301, 5529–36, 5492. Refuse cast into gravel pits, 5507–20; finds no sale amongst farmers, probably because devoid of liquid passed into subsoil from cesspools, 5535–6. Sewage Irrigation; land available below town, and fall convenient, 5147–52. Water Supply, no public supply; only from private pumps in gravel; cesspools also in gravel, the new ones cemented not the old ones, 5062–8, 5262–71; no ill-health traced to corrupt water supply, 5224–31.

Waterclosets:
See *Barnet, Edmonton, Enfield, Luton, Stortford, Tottenham, Ware, West Ham, East London Waterworks Company*, 312, and 658–9 [Appendix No. 1], *New River Company*, 1186–8.

Water Power:
Irregularity of 2550, **2589–90**, injured by floods 2271–3, 2594; 2286–8; decreasing on tributaries? 2316–9 on Lee 2305–25, 2329–45, on Lynch unaltered 4840. See *Mills*.

Water Supply:
See *Barnet, Edmonton, Enfield, Hertford, Luton, Stortford, Tottenham, Ware, West Ham, East London Waterworks Company, New River Company.*
Difficulty of increasing; water-bearing subsoil of Lee Valley is so porous that if tapped it would give out into sewers the sewage it had absorbed, 709–11, and if intercepting sewers laid down, they would carry away spring water, 712–23, 822. Possibility of Storage Reservoirs, see *Reservoirs*. Economy in supply possible; 11 gallons enough with care 3131, 1018–20, and see *East London Waterworks Company, New River Company* and *Tottenham*.

Weeds:
Good for water, except in autumn, when they decay, 1142–5.

Weirs:
Ancient, on Lee, 677–9; now iron instead of wood, so as to give more waterway 4888, disputes as to, on Stort, 4875–6.

Well:
Infiltrated with sewage in East London, **1022–6**, 3190–203. Edmonton? 3533–7, 3785–6. Luton, 1513–22, 1921–30, 1907–8, 1654–76. Tottenham? 3531–6, 3785–6? Ware 5062–8, 5262–71.

Welwyn:
Pollution of Mimram at 2617–8.

[*Numbers* 3236–3336 *are repeated in the Evidence: when in the Index the reference is made to the numbers as used the second time, the numbers are distinguished by an asterisk.*]

West Ham:
Witness examined:
Engineer to Local Board, Mr. Marshall, 4016–118, 4118–9 [Paper].
Population 60,000, fast growing 4021, 4028–31. Area 5,000 acres, 4118–9 [Paper]. Rateable value 160,000*l.*, 4032. Health improved by sanitary arrangements, 4118–9, [Paper]. Sewerage; 10,000 out of 12,000 houses drained, 4118–9 [Paper]. Cost of, 4033–5. Sewers work well, ventilation perfect, 4050–7. Silvertown, cut off by Victoria Docks, unsewered and a cause of pollution, 4066–7. Sewage passes into Lee; partly pumped at cost of 1,000*l.* per ann., partly by gravitation, 4038–9 Place of outlet Bow Creek, 4020. Time chosen whilst tide is receding to prevent sewage returning to Lee, 4096–100. Proposed outlet to Barking, 4085–90. Waterclosets no trouble, 4024; and a vast improvement upon former condition when privies and cesspools discharged into ditches, 4118–9 [Paper]. Sewage Irrigation tried experimentally and promised to be successful, but land in neighbourhood too valuable, 4040–8, 4077–84, 4111–8. Water Supply, East London works, 4025–7; Local Board endeavours to compel owners to provide means at houses for receiving water, but legal powers insufficient, 4101–10. Low cellars by Barking Road 14 feet below high-water line, 4073–7.

Wilds, Mr. (of Hertford):
Evidence of, 4698–729.

Willis, Mr. (of Luton):
Evidence of, 1718–806.

THIRD REPORT

OF

THE COMMISSIONERS

APPOINTED TO INQUIRE INTO

THE BEST MEANS OF PREVENTING THE POLLUTION OF RIVERS.

(RIVERS AIRE AND CALDER.)

VOL. I.

REPORT, APPENDIX, PLANS.

Presented to both Houses of Parliament by Command of Her Majesty.

LONDON:
PRINTED BY GEORGE EDWARD EYRE AND WILLIAM SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.
FOR HER MAJESTY'S STATIONERY OFFICE.

1867.

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COMMISSION.

VICTORIA R.

Victoria, by the Grace of God, of the United Kingdom of Great Britain and Ireland, Queen, Defender of the Faith.

To Our trusty and well-beloved Robert Rawlinson, Esquire, John Thornhill Harrison, Esquire, and John Thomas Way, Esquire, greeting.

Whereas We have deemed it expedient for divers good causes and considerations that a Commission should forthwith issue for the purpose of inquiring how far the present use of rivers or running waters in England for the purpose of carrying off the sewage of towns and populous places, and the refuse arising from industrial processes and manufactures, can be prevented without risk to the public health or serious injury to such processes and manufactures, and how far such sewage and refuse can be utilised or got rid of otherwise than by discharge into rivers or running waters, or rendered harmless before reaching them; and also for the purpose of inquiring into the effect on the drainage of lands and inhabited places of obstructions to the natural flow of rivers or streams caused by mills, weirs, locks, and other navigation works, and into the best means of remedying any evils thence arising.

Now know ye, that We, reposing great confidence in your zeal and ability, have authorised and appointed, and do by these Presents authorize and appoint, you, the said Robert Rawlinson, John Thornhill Harrison, and John Thomas Way, to be Our Commissioners for the purposes aforesaid.

And for the better enabling you to form a sound judgment on the Premises, We do hereby authorize and empower you, or any two or more of you, to call before you, or any two or more of you, all such persons as you may judge most competent by reason of their situation, knowledge, or experience, to afford you correct information on the subject of this inquiry.

And it is Our further Will and Pleasure that you, or any two or more of you, do report to Us in writing, under your hands and seals, your several proceedings by virtue of this Our Commission, together with your opinion on the several matters herein submitted for your consideration.

And We Will and Command that this Our Commission shall continue in full force and virtue, and that you, Our Commissioners, or any two or more of you, may from time to time proceed in the execution thereof, although the same be not continued from time to time by adjournment.

And for your assistance in the due execution of this our Commission, We have made choice of Our trusty and well-beloved Godfrey Lushington, Esquire, Barrister-at-Law, to be Secretary to this Our Commission, whose services and assistance We require you to avail yourselves of from time to time, as occasion may require.

Given at Our Court at Saint James's, the Eighteenth day of May 1865, in the Twenty-eighth Year of Our Reign.

By Her Majesty's Command.

(Signed) G. GREY.

Instructions to the Commissioners.

Gentlemen, Whitehall, May 30, 1865.

Her Majesty having been pleased to appoint you to be Commissioners for Inquiry into the Pollution of Rivers, I am directed by Secretary Sir George Grey to send you the following instructions for your guidance in the proposed inquiry.

Although it may be taken as proved generally that there is a wide-spread and serious pollution of rivers both from town sewage and the refuse of mines and manufactories, and that town sewage may be turned to profitable account as a manure, there is not sufficient evidence to show that any measure absolutely prohibiting the discharge of such refuse into rivers, or absolutely compelling town authorities to carry it on the lands, might not be remedying one evil at the cost of an evil still more serious, in the shape of injury to health and damage to manufactures. It is, therefore, suggested that your inquiry should include selected river basins, illustrating different classes of employment and population; that these river basins might be:—

1st. The Thames Valley—both as an example of an agricultural river basin, with many navigation works, such as locks and weirs and mills affecting the flow of water, and many towns and some manufactories discharging their sewage and refuse into the stream from which is mainly derived the water supply of the metropolis.

2d. The Mersey Valley—including its feeders, particulary the Irwell, as an example of the river basin, most extensively polluted by all forms of manufacturing refuse, particularly that arising from the cotton manufacture and processes connected therewith.

3d. The Aire and Calder Basin, as an additional example of the same class, particularly in connexion with the woollen and iron manufactories.

4th. The Severn Basin, for the same reason, but in particular connexion with the great seats of the iron trade.

5th. The Taff Valley, in connexion with mining and industry applied to metals.

6th. A river Basin comprising a mining district in Cornwall.

Your special points of inquiry should, it is conceived, be in the Thames Valley. 1. The condition of the river as affected by mills, weirs, and locks, and as affecting the drainage of towns and villages and adjacent lands. 2. The condition of the river, as affected both by the discharge of sewage from towns and villages, and the refuse of manufactories, paper mills, &c., and the possibility of intercepting and rendering useful or innocuous these sources of pollution.

As to the other rivers mentioned, the main object of the inquiry should be how far the use or abuse of the rivers is, under present circumstances, essential to the carrying on the industry of these districts? How far by new arrangements the refuse arising from industrial processes in these districts can be kept out of the streams, or rendered harmless before it reaches them, or utilised or got rid of otherwise than by discharge into running waters? In the course of these investigations you will make inquiry into the effect on health and comfort of the existing system of sewage of towns and populous places in the districts examined, and into the best mode of protecting individual and public interests in the purity of running water.

Secondary questions will, no doubt, arise contingent on these leading points, in which case you will include them, as far as it is necessary, within the scope of your inquiry.

I am, &c.

(Signed) H. Waddington.

R. Rawlinson, Esq.,
J. T. Harrison, Esq.,
J. T. Way, Esq.,
Commissioners to inquire into the
Pollution of Rivers.

Letter from H. Waddington, Esq., to the Commissioners appointed to inquire into the Pollution of Rivers.

Gentlemen, Whitehall, July 7, 1865.

I am directed by Secretary Sir George Grey to transmit to you an extract of a letter from Mr. Charles Neate, and to state that it will be desirable to include in your inquiry into the Pollution of Rivers, the subject of the water supply suggested by Mr. Neate, provided such extension of your inquiry will not materially impede or delay the completion of the primary object of the Commission.

I am, &c.

The Commissioners appointed to inquire into the Pollution of Rivers,
2, Victoria Street, S.

(Signed) H. Waddington.

Letter from Charles Neate, Esq., M.P., to the Right Honorable Sir George Grey, Bart., G.C.B., M.P.

Dear Sir, House of Commons, June 27, 1865.

I beg to submit to you, with reference to the Commission recently issued to inquire into the means of remedying the pollution of rivers, that as the scope of that Commission has already been enlarged beyond its original and professed object, so as to include an inquiry into the drainage of "lands and inhabited places," it would be right to extend the inquiry still further as to include the great question of the water supply.

Even if the drainage referred to in the Commission is that only which is required for sanitary purposes, it may still be a question whether you might not subject the health of the country to far greater danger by wasting too rapidly the winter supply of water than it now is liable to from the temporary dampness of the soil in certain places.

The effect of drainage, even to the extent it has been already carried out for agricultural purposes, is a subject of serious alarm to many people, and I think it is matter of pressing interest to inquire how far the general level of springs in the country has been lowered, how far it depends upon the height at which the water is maintained in the neighbouring river, and what is the number of springs that have altogether failed, or at least that fail during the summer.

I believe it to be a matter of urgent necessity to provide reservoirs of water throughout the country, to be used for all purposes but drinking, and that the spring water should be habitually confined to that use.

If the Commission, as it stands, is intended to apply to agricultural drainage, the reasons for extending the inquiry are more, still more cogent, for then it is no longer a conflict between one sanitary purpose and another, but between the health of the country and some increase in the productiveness of the soil.

I remain, &c.

The Right Honorable Sir George Grey, Bart., G.C.B., M.P., &c., &c., &c.

(Signed) Charles Neate.

P.S. I think it would be a great point to inquire whether all the surface drainage of towns might not conveniently be kept out of the service and taken into the rivers.

SIR, Whitehall, June 24, 1867.

I AM directed by Mr. Secretary Hardy to transmit to you the Warrant under Her Majesty's Royal Sign Manual appointing Ralph Augustus Benson, Esquire, to be Secretary to the Rivers Pollution Commission, in place of Godfrey Lushington, Esquire, who has resigned such appointment.

I am, &c.

Robert Rawlinson, Esq., C.B. (Signed) H. WADDINGTON.

VICTORIA R.

Victoria, by the Grace of God of the United Kingdom of Great Britain and Ireland Queen, Defender of the Faith.

To Our trusty and well-beloved Robert Rawlinson, Esquire, Companion of Our most honorable Order of the Bath, John Thornhill Harrison, Esquire, and John Thomas Way, Esquire, greeting.

Whereas We were pleased by Warrant under Our Royal Sign Manual bearing date the Eighteenth day of May 1865, constituting you, Our Commissioners, to make inquiry into the Pollution of Rivers, and for the other Purposes therein set forth, to appoint Godfrey Lushington, Esquire, barrister-at-law, to be Secretary to the said Commission:

And whereas the said Godfrey Lushington hath resigned such appointment:

Now know ye that, in room of the said Godfrey Lushington, we have made choice of Our trusty and well-beloved Ralph Augustus Benson, Esquire, barrister-at-law, to be Secretary to such Commission, whose services and assistance We require you to avail yourselves of from time to time, as occasion may require.

Given at Our Court at St. James's the Twenty-second day of June 1867, in the Thirty-first Year of Our Reign.

By Her Majesty's command.

(Signed) GATHORNE HARDY.

THIRD REPORT.

TO THE QUEEN'S MOST EXCELLENT MAJESTY,

MAY IT PLEASE YOUR MAJESTY,

WE, Your Majesty's Commissioners appointed to inquire into the pollution of rivers and running waters, having reported on the main stream of the river Thames and on the river Lee, now proceed to report on the rivers Aire and Calder, the principal seat of the Woollen and Worsted trades in the West Riding of Yorkshire.

Having made preliminary inspections of the West Riding district during portions of the summer of 1866, we proceeded to hold our public inquiries during the autumn, in the following order:—

Name of Town.	Name of River.	October.	November.	December.
Wakefield	Calder	16th.	—	—
"	"	17th.	—	—
"	"	18th.	—	—
"	"	19th.	—	—
Dewsbury	Calder	22d.	—	—
"	"	23d.	—	—
Huddersfield	Colne, tributary of Calder	25th.	—	—
"	"	26th.	—	—
"	"	27th.	—	—
Leeds	Aire	—	6th.	—
"	"	—	7th.	—
"	"	—	8th.	—
"	"	—	9th.	—
Bradford	Bradford Beck, tributary of Aire	—	13th.	—
"	"	—	14th.	—
"	"	—	15th.	—
Halifax	Hebble Beck, tributary of Calder	—	16th.	—
"	"	—	17th.	—
Todmorden	Calder	—	19th.	—
Keighley	Worth, tributary of Aire	—	27th.	—
"	"	—	28th.	—
Skipton	Aire	—	29th.	—
Pontefract	Aire and Calder united	—	30th.	1st.

In prosecuting our inquiries we received all the assistance we required from the several Municipal Corporate bodies, Towns Commissioners, Local Boards of Health, Parish authorities, and others. In no instance did any of the manufacturers applied to decline to allow their works to be inspected, or to furnish information as to the materials used and pollutions caused to running waters. The evidence, as published in detail, shows that on the contrary, in many instances, considerable expense and labour were incurred to obtain special information for our use to enable us to ascertain the leading facts bearing on the question of rivers pollution which we were commanded to report upon.

The rivers Aire and Calder have this in common with the Thames and Lee, upon which we recently reported, that they are navigable streams, and are polluted by town sewage; but the Aire and Calder suffer to a far greater extent than the Thames and Lee from manufactures, by which they are in some instances polluted to the utmost limits of which they are capable.

While domestic water supply to the populations seated at various points upon their banks, and to 3,037,991 persons inhabiting the Metropolis, is by far the most important use to which the waters of the Thames and Lee are appropriated, the water of the Aire and Calder, and that of their numerous tributaries is, in consequence of its foul condition, not used so much as it formerly was for domestic purposes, but mainly for carrying on the Worsted and Woollen manufactures, and other important trades of the district. Thus the rivers Thames and Lee require to be purified, that their waters may be preserved wholesome for domestic uses. The rivers Aire and Calder require to be

improved and conserved, that injurious flooding may be prevented; they should be protected from pollution, that the trades established in the district may be carried on to the greatest advantage, and means should be afforded to preserve the water pure for the domestic purposes of a large population.

Yorkshire: its Topography, Meteorology, Geology, &c.

Yorkshire, the largest county in Britain, containing 5,983 square miles, and in 1861 a population of 2,015,541, is bounded on the north by Durham, on the east by the North Sea, on the west by Westmoreland, Lancashire, and Cheshire, on the south by Derbyshire, Nottinghamshire, Lincolnshire, and the river Humber, and is divided into three ridings—North, East, and West. The Pennine mountain chain extends from Scotland, forming the western highlands of Yorkshire, on to Derbyshire. The highest points in this mountain range are Mickle Fell, 2,600 feet, Whernside, 2,384 feet, and Ingleborough, 2,361 feet above medium tide level. The north-western portion of the county consists of Cambrian, Silurian, Scar limestone, and Yoredale rocks; on the eastern slope of this range of mountains, Millstone grit of varying breadth forms moor and mountain from Durham to Derbyshire. The Yorkshire coal-field extends from Leeds in the north to Derbyshire in the south, and is in area about 700 square miles. A considerable breadth of Mid-Yorkshire is New Red Sandstone, with a strip of Permian strata on the west. In the south-eastern portion of the county, from the Humber to Filey Bay, the subsoil consists of Chalk. From Filey Bay northward to the Tees mouth are found Coralline oolite, Bath oolite, and Lias shales. Alluvium, such as boulder-drift, clay, silt, gravel, and sand is found in the valleys.

The geographical configuration of the West Riding of Yorkshire and its geology are alike favourable to the establishment and prosecution of manufactures requiring water. The mid-mountain ranges of this portion of England trending north and south are at a sufficient elevation to intercept rain-clouds and condense vapour brought from the Atlantic Ocean by the south and west winds. The strata are well fitted to receive the rain, and to pass it down through the numerous rivulets, streams, and rivers. The main dividing ridges being to the west, and for the most part forming the boundary of the county, the greater portion of rain precipitated flows through the county eastward to the North Sea. It has been calculated that, out of each 100 parts of rain-water falling on the surface and flowing off either from springs or floods, 80 parts find their outlet by the Humber, 13 parts direct to the North Sea, and only seven parts into the Irish Sea.

The West Riding is traversed from east to west by three valleys almost parallel. These are the vales of Wharfe, Aire, and Calder. Mountains of millstone grit, largely covered with moorland, bound the coal-field of Yorkshire on the north and west, and it is from this stratification that much of the pure spring water is derived. Bradford, Halifax, Dewsbury, and some other towns have recently constructed impounding reservoirs on the millstone grit for their domestic supply, and also for trade purposes.

The rainfall over Yorkshire varies with relative position and elevation. On the south and eastern part it is least, having an average annual fall of about 20 inches. The middle district, up to an elevation of 1,000 feet, averages about 30 inches; and on the mountain ranges and their slopes down to 1,000 feet of elevation the average rainfall varies from 30 inches up to 80 inches.

The surface area of a country, the amount of rain falling and of vapour condensing upon it, and the capacity of the subsoil-rocks for receiving and storing water form data from which to calculate the approximate yield of any watershed. Rain-gauges indicate the volume of rain falling in their immediate vicinity, but actual gaugings of water flowing off the ground give the only reliable data as to the dry weather and ordinary volume of water discharged. River floods cannot accurately be measured as to volume, neither can the injurious effects of such floods be easily estimated.

Over all this district dry and wet years vary about as 1 to 2. Where averages have been made from continuous observations over 30 or 40 years it will be found that deducting one third will indicate the total fall of rain in a dry year, and adding one third will give the fall or excess of rain in a wet year. On the south-east coast a dry year's rainfall will be 14 inches, and a wet year 28 inches. In the middle district a dry year will be 20 inches and a wet year 40 inches, or thereabouts. The dry weather flow of water on the surface is modified by aspect, elevation, surface-contour, and most of all by the geological character of the subsoil. The perennial flow is modified by

these conditions and by the amount of rainfall, as also its times and modes of falling. The actual flow of water from the ground as measured in springs, streams, and rivers varies in accordance with climate, volume of rain falling, the period or season within which the rain falls, the character of the subsoil, surface-contour, and some other conditions; but under the most favourable conditions much of the rain is again evaporated.

In the drainage areas of the Thames and Lee, where accurate gaugings of the rain and measurements of the rivers have been taken for waterworks purposes, it is found that out of an annual average fall of 27 inches over the area of the Thames watershed, one-sixth percolates and forms springs, one-sixth passes off as flood water, and four-sixths are evaporated; while in the case of the Lee watershed, where the average rainfall is 25 inches, nearly four-fifths pass off by evaporation.

These proportions are, however, only an approximation to the averages of rainfall given; with greater or less rainfalls on the same areas the proportions will vary. It might be supposed that some water is absorbed in the strata and so is lost or expended in the sea at great depths below the surface. No experienced geologist will, however, admit this as a practical solution. Springs, as a rule, deliver the absorbed rainfall of such a district as the West Riding of Yorkshire at the surface and at no great distance. There may be some small springs in the sea having their origin near the shore, but not of volume seriously to affect the question. Limestones, which are much fissured, are uncertain in their surface-delivery of water where small areas have to be considered, but are more conformable to a general law where large areas have to be relied upon. Limestones are wasted and more or less fissured and caverned by the solvent action of soft water, so that there may be areas of surface of many acres in extent receiving and absorbing or evaporating all the water falling on the surface; such areas are not fitted for the formation of impounding reservoirs, as fissures not showing themselves at the surface may exist, which, when covered with water under pressure, would receive and discharge the entire volume at some point below, as in the case of the water from Malham Tarn. The enormous waste in limestone strata constantly and silently taking place by the solvent action of soft water can only be roughly indicated. Rain water, when brought into contact with lime rocks possesses the power of dissolving and removing as much as 20 grains of carbonate of lime in each gallon; taking a mean of 15 grains to the gallon, more than one ton of carbonate of lime is removed with each million gallons of water.

The dry weather flow from the whole of Yorkshire may be about a half cube foot of water per second from each 1,000 acres. The flood flow on the mountain slopes is from 200 to 500 cube feet per second from each 1,000 acres for short intervals. The beneficial use of rivers depends on the dry weather and medium flow. Floods are to be guarded against as liable to cause injury, of which much experience has been gained during the autumn, winter, and spring of 1866 and 1867. Excessive floods have been hitherto very little modified, either by land drainage or by storage reservoir making, but abuse by throwing solids into the streams, encroachments, and general neglect have tended to aggravate their destructive effects. A full history of the neglect and abuse of the streams in Yorkshire during the last half century, and of the consequent losses by floods, ought to teach the manufacturers that nature will take her own mode of avenging herself.

Rainfall and rivers mould and modify the surface of the land. Sunlight, wet, frost, and wind expand, dissolve, disintegrate, and disperse the solid materials exposed to their unceasing action. Rain forms springs, and rivulets; these form rivers, and by their combined action solids are chemically dissolved and mechanically washed down to the ocean. Bright and sparkling water generally contains carbonate of lime. Bright brown (or coffee-coloured) water is usually soft and derives its colouring from dissolved peat. Muddy water contains the fine particles of rocks in suspension, the weight of the solids removed being in proportion to the volume and velocity of the water in the river, and the geological formation of the district drained. From the mountain sides of Yorkshire heavy rain washes down masses of rock, boulders, gravel, and sand to an enormous extent; these solids tend to block the beds of the streamlets and rivers, and where manufactures have been established much damage to property occasionally takes place by flooding.

District of the Rivers Aire and Calder.

The district watered by the rivers Aire and Calder forms part of the great drainage area of the river Ouse, which contains 4,207 square miles. The main watershed falls from the north and west to the east.

	Sq. Miles.
The basin of the river Aire is - - - - -	342½
The basin of the river Calder is - - - - -	366
The basin of the united rivers from Castleford to the Ouse -	85½
Total area - - - - -	794

The springs above and within Malham Tarn, situated on Scar limestone, at an elevation of 1,243 feet above Ordnance datum, form one of the main sources of the river Aire. This tarn, or small lake, is near the ridge dividing the watersheds of Westmoreland, Lancashire, and Yorkshire. It is bounded on the north and west by Kilnsea Craig, 1,475 feet elevation, Hard Flask, 1,746 feet, Bordley Mastiles, 1,346 feet, and Fountains Fell, 2,190 feet. The limestone is fissured immediately below the outlet of Malham Tarn, the whole volume of water being absorbed by "swallow holes," to re-appear at about two miles distance in Malham Cove.

The river Calder rises at an elevation of about 1,500 feet, on the mountain ridges of millstone grit dividing Lancashire and Yorkshire; two small streams, the Cal and the Der, united near Todmorden, becoming after this junction the Calder. The Aire and Calder, uniting their streams at Castleford become the Aire until joining the Ouse, which river finds an outlet through the Humber to the North Sea.

The watersheds of the Aire and Calder may be tabulated as respects their geological characteristics as under—

	Area of Scar Limestone in Square Miles.	Area of Millstone Grit in Square Miles.	Area of Coal formation in Square Miles.
The basin of the Aire - -	95	137½	110
The basin of the Calder - -	—	191	175
Total - -	95	328½	285

	Area of Permian in Square Miles.	Area of New Red Sandstone in Square Miles.	Area of Alluvium in Square Miles.
The Aire after its junction with the Calder down to the Ouse - - -	30	30½	25
Total square miles -	30	30½	25

Abstract.

Area of Scar Limestone in square miles - - - -	95
,, Millstone Grit ,, - - - - -	328½
,, Coal formation ,, - - - - -	285
,, Permian formation ,, - - - - -	30
,, New Red Sandstone ,, - - - - -	30½
,, Alluvium ,, - - - - -	25
Total area of the combined watersheds - - -	794

Obstructions and Pollutions of the Rivers Aire and Calder.

The rivers Aire and Calder throughout their whole course are abused, obstructed, and polluted (to an extent scarcely conceivable by other than eye-witnesses) from Skipton on the Aire, from Todmorden on the Calder down to Castleford. Our inspection

was corroborated by uncontested and overwhelming evidence; by the engineer to the Aire and Calder Navigation as also by the men employed in dredging. Pollution by solids—ashes, mud, and other "powse"—is increasing and will yearly become worse unless some remedial measures be rigidly enforced.

It is impossible to treat quite separately the questions of obstruction and pollution. In many cases, where solids are carried into a stream, both injuries are of course inflicted upon it.

The rivers Aire and Calder, and their tributaries, are abused by passing into them hundreds of thousands of tons per annum of ashes, slag, and cinders from steam-boiler furnaces, ironworks, and domestic fires; by their being made the receptacle to a vast extent of broken pottery and worn-out utensils of metal, refuse brick from brick-yards and old buildings, earth, stone, and clay from quarries and excavations, road scrapings, street sweepings, &c.; by spent dyewoods and other solids used in the treatment of worsteds and woollens; by hundreds of carcases of animals, as dogs, cats, pigs, &c., which are allowed to float on the surface of the streams or putrify on their banks; and by the flowing in, to the amount of very many millions of gallons per day, of water poisoned, corrupted, and clogged by refuse from mines, chemical works, dyeing, scouring, and fulling worsted and woollen stuffs, skin-cleaning and tanning, slaughter-house garbage, and the sewage of towns and houses.

The practice of periodically flushing out into the streams the mud which must under any circumstances accumulate in goits, culverts, mill reservoirs, or "lodges" and canals is also a palpable abuse.

It would be impossible to calculate the extent or the profit to which the natural products of the West Riding, stone, coal, iron, and other minerals, have been worked, while the profits realized in the textile manufactures of worsteds and woollens since the modern establishment of those trades (about the year 1735) might perhaps exceed the amount of our national debt; and the trade, according to the evidence we have received, is still on the increase in the few places where water fit for use can be obtained.

But the growth of manufactures, the accumulation of wealth, and the increase of population in the West Riding are intimately connected with the abuse and pollution of its rivers. Many streams, where, by reason of their foulness, no form of life can at present be found, persons now living recollect abounding in fish. These appear to have been totally destroyed by the accumulated filth and the amount of solid refuse carried in suspension, as, in a large reservoir into which the river water at Wakefield is passed and where the water being at rest is clarified by mere mechanical subsidence of the solids, fish live and breed; nor will they be killed, as has been ascertained, even by the flow of town sewage *while it is fresh*, where it does not exceed one-tenth the volume of the stream into which it passes, and where the water is in unceasing motion downwards, not tidal as in the Thames at London.

The rapid increase of all forms of manufacture, as now carried on in Great Britain, received an immense impetus by the maturing of mechanical power through the aid of steam. Water-power is uncertain and troublesome, and its utmost limits may soon be reached on streams such as those in Yorkshire. There are no large lakes in the West Riding to equalize the delivery of water, but the manufacturer must be subject to the irregularity of seasons involving excesses of droughts and floods. Artificial reservoirs, which have been in some places constructed, in proportion to their capacity and management, tend to equalize the delivery of water, but they are costly to construct; and if not efficiently managed, they may become eminently dangerous and awfully destructive, as at Holmfirth, and at Sheffield.

Steam-power has consequently been provided to an enormous extent, in many instances to supplement water-power, but in more instances to be the prime and sole agent; and it involves the annual use of millions of tons of coal. Of this there remains on an average about one-eighth, after combustion, in the form of solid cinder or ash; and in the numerous valleys where large mills have been erected with steam-power, mill above mill, cinder and ash resulting from their vast consumption of coal has been and is at this time being thrown into the adjoining watercourse, so that during dry weather periods the greater portion of the bed of the river opposite such mill or works is filled by the "cinder tip." A stranger to the district, looking upon such state of things for the first time, thinks it must be the deliberate intention of the manufacturer, for some trade purpose or other, entirely to block the river at this point. In other instances a "slag or cinder tip" is made parallel to the banks of a rivercourse to a depth of many feet, and at the steepest angle the materials will form. In both cases flood-waters are expected to wash the solids so arranged down

the river, regardless of all contingencies to other riparian proprietors. To these the consequences are inevitably disastrous, and the practice can scarcely be considered an advantage to the manufacturers who so abuse the streams. One result of this form of abuse is the gradual raising of the beds of the rivers above their former levels, and so causing floodings over the adjoining lands, and in some cases damaging mills. For purposes of trade, many of the millowners on the streams and rivers where land is available, construct "*goits*" and "*lodges*" to store water and obtain head for power, as also to allow of subsidence that the water may be used for washing and dyeing purposes. There are lines of mills so provided for, one below the other on the same stream. The uppermost mill receives water in the purest state; but even in so advantageous a situation sludge accumulates, both in the goit and in the lodge. This mud is periodically flushed out into the river, to foul its bed below, and portions of such mud are necessarily received into the next goit and lodge; the same sort of process going on, with the addition of cinders and dye-waste, to the last or lowest mill on that stream, the river below being ultimately polluted by the whole accumulated mud, dye-waste, and refuse ashes of the entire district above. The streams and rivers are further abused by the inhabitants generally who live on their banks, whether residing in isolated houses, villages, or towns; and so far has this abuse grown into a general practice, that even legally constituted Parish and Township authorities, Local Boards of Health, and the more dignified Municipal Corporations either directly practise abuses or connive at them by permitting their continuance. The streams and rivers seem to be considered the cheapest scavengers and removers of waste solids.

The penalties which nature exacts of the inhabitants of a district who so violate common sense by systematic abuse of water-courses are severe. When we commenced our recent inquiries in the West Riding, one opinion was reiterated by the witnesses examined, namely, that floodings by the rivers were neither so common nor so severe as formerly. Reservoir making to impound flood waters, and land-draining, with general cultivation, were supposed to have so modified all former conditions that flooding, as in olden times, was deemed impossible. The inhabitants of the valleys of the rivers Aire and Calder, because damaging floods had not occurred for several years, concluded that no more such floodings would take place. But before we had completed our inquiries, and whilst we were sitting taking evidence in Halifax, on Thursday 15th of November 1866, rain had commenced, and continued for several days flooding the valleys of the Aire and Calder most destructively from the mountains to the sea.* This flood rose as high and did far more damage to property than any flood at any former period. In several instances persons were washed away and drowned. It is not possible to form any reliable estimate of the money value of the damage it caused in the worsted and woollen districts to the manufacturers, landowners, and others of the West Riding, the property of so many thousands of persons having been destroyed or damaged. The total loss was locally estimated at from half a million to one million sterling. The lesser sum, if laid out in works of permanent improvement, would have been sufficient to put the rivers in condition to render such destruction of human life and great waste of property impossible. The loss by many thousands of the working classes and their families of time, wages, and of health, consequent on this week's flooding must also have been great, as, when such floods subside, damp floors and damp walls remain for many subsequent weeks, causes of discomfort and of disease. But as previously stated these excesses may be guarded against. Making additional impounding reservoirs will tend to equalize the flow of flood waters from small areas, but there must not be less than 100,000,000 gallons of storage to each 500 acres of gathering ground to control floods, and even then a flood may come down upon a full reservoir, almost as strong as if no reservoir existed. Under-draining and cultivating land may pass surface or rain-flood waters more rapidly, but neither reservoir making, land draining, nor cultivation will affect the amount of evaporation from the oceans and consequent rainfall. This is and ever will be entirely independent of any works of man. Evaporation is continuous, and dependent on the sun's heat; condensation is due to terrestrial influences, and may be very unequal from local causes. It is sufficient to know that excesses in rainfall may be repeated, will inevitably be repeated, and cannot be prevented. Any work, to be useful, must provide means to lessen contingent damages: these floods warn us that neglect and abuse of rivers cannot be continued with safety either to life or to property. The neglect consists in allowing gravel, sand, and silt washed down from the mountains to raise the beds of the streams; the abuses consist in

* See Appendix No. I., p. lvii.

deliberately further filling those beds with cinders and ashes from steam-boiler furnaces, and with other refuse solids previously mentioned; or, as at some of the great ironworks, forming slagheaps parallel with the river, and tipping refuse along the slope; besides which obstruction has been offered to the free flow of flood waters by unjustifiable encroachments; dams, walls, culverts, &c., as also by bridges and other public works of defective construction. It is worthy of remark in respect of the most salient feature in this obstruction of rivers, namely, the practice of throwing in vast quantities of cinder and ash from the mills, that it is closely allied to another nuisance, that of polluting the atmosphere by the emission of dense volumes of smoke from factory chimneys. In our inquiries as to the weight of ashes produced and what became of them, we learned that in the use of any coal, rich and bituminous or poorer and more earthy, if there be careful firing and perfect combustion there will be less cinder as well as less smoke. Experiments have proved this fact. Some large mills have their machinery driven by steam boilers which do not produce smoke, but prolong the life of the boiler, work at less risk of explosion, and with greater economy; and yet this practice does not become general, because there is some expense in alterations to steam-boiler furnaces in the first instance, and care in firing, as also in general management, is required subsequently. As ashes must be removed at a cost proportionate to the distance to which they must travel, and the difficulty of finding places of deposit, it is satisfactory to find that their bulk can thus be materially reduced by smoke consumption with increased profit to the manufacturer.

Pollution by Sewage.

The pollution by which we found the rivers Aire and Calder most grievously affected consist partly of such as are common to all streams flowing through a densely populated district, as town sewage, but, in a greater degree, of refuse solid and liquid from the special manufactures established upon them and their tributaries.

The amount of solids taken into the streams by sewers is in the aggregate throughout the West Riding enormous. At Leeds the volume of sewage passing into the Aire is from eight to ten million gallons per day, the entire weight of solids being swept out therewith; and this is the case throughout the district wherever main sewers and drains exist. In no single instance did we find any system of intercepting the solids from sewage, such as has been enforced at Birmingham, the corporation has been compelled to construct tanks for the purpose. The dry weather flow of sewage of Birmingham is about ten million gallons per day, and it is found that the weight of solid intercepted amounts to some 25,000 or 30,000 tons per annum, including to some extent refuse from manufactories and grit from the roads, all of which formerly contaminated and silted up the banks and bed of the river Tame. Interception of solids in this manner is, however, not to be advocated as a substitute for sewage irrigation.

Most of the towns in the West Riding have been partially sewered, and some houses have also been drained; but in no single instance has this necessary work been thoroughly done. The entire volume of sewage at Leeds (fluids and solids) is passed direct into the river Aire. This is also the case at Bradford, by the Bradford Beck; and at Keighley, and at Skipton. The river Calder receives sewage from Todmorden, Halifax, Huddersfield, Dewsbury, Wakefield, and smaller towns, villages, mills, and houses. No town or village intercepts sewage. At most of the large mills the privies for the workpeople are arranged in such manner that the excrements fall into a receptacle which can be removed to land where they are applied to purposes of agriculture, but even at these places the arrangements are neither so cleanly nor so inodorous as they ought to be and may be. Where sewers and drains are not admissible, the dry-earth closet, or some such arrangement, if well attended to, will be less offensive than where no other disinfectant is used. *Dry-earth closets are partially in use at Wakefield House of Correction in separate cells, and they may be made to answer for mill hands, for villages, and for groups of houses, as also, of course, for single houses; they are, however, by no means to be advocated as preferable to sewers, drains, and water-closets. The present gross abuse of the rivers which we inspected may in a great measure be prevented, and in such manner and at such cost as to be beneficial to all parties. Sewage may be purified by passing it over the land, and the solids of dye-waters and other refuse waters may be filtered out so that the streams may become clean.

* See Appendix No. II., p. lix.

The dark and foul appearance of the West Riding rivers is mainly due to insoluble dye-matter discharged from the works; but dye-refuse in general, though in this sense highly objectionable, really tends to a considerable extent, by the disinfecting action of the mineral ingredients and acids it contains, to neutralize the corruption of town sewage. Where, on the other hand, the dye refuse is not discharged in sufficient quantity, that offensive matter, deposited on the beds and banks of the streams, becomes, in dry weather, putrid and stinking, and in floods is stirred up and floated forward to poison the navigable parts of the river and the canals, where deposit can again take place. The most notable case of extreme pollution on record is that of the Bradford canal.

The sewering of towns is a complex question and requires to be specially studied, so as to effect the greatest amount of good at the least risk of polluting water-courses; natural streams, as small brooks, should not be arched over and formed into sewers, neither should rivers be made the receptacles of sewage. The largest proportion of rainwater may in all cases be turned over the surface into the natural streams; it will not be necessary to form duplicate systems of sewers and drains, but it will require intelligent and careful attention to preserve surface gradients and natural outlets for storm waters, and, where these have been tampered with, to restore and improve them. The sewers and drains of a town should provide for the removal of subsoil water, the slop and waste water from houses, and the contents of waterclosets; these sewers and drains may have storm overflows in connexion with the natural streams of the district so arranged as to prevent flooding of houses or bursting of the sewers during thunder-storms. All dry-weather sewage and such portion of the surface water due to moderate falls of rain as finds its way to the sewers will flow down with the sewage to the outlet, and be a manageable volume either to apply by gravity, or to be pumped to land for agricultural uses.* The remark may be made that, when the sewers overflow, the streams will be polluted; this is true, but the pollution will be a minimum, the sewage will be in extreme dilution, and the natural streams of the district will be in flood and most probably muddy by grit and silt washed in from road surfaces, and by fine particles of soil from the banks and the surfaces of the land. Floods caused by heavy rains ever have been turbid and ever will be turbid.

There are large areas of land, both in the Aire and Calder valleys, which would be greatly benefited by a proper application of sewage. It may be profitably applied to the production of Italian rye-grass. Where sewage will flow over a sufficient area of land by gravity there ought to be the best return for the expenditure, but towns having populations of 10,000 and upwards may venture to incur the cost of pumping sewage, and so reach land less valuable than the rich garden or meadow land at lower elevations. The only general rules applicable to sewage irrigation in all cases are that the works should be simple and cheap. Land to be irrigated does not require costly work in shaping and levelling, neither need there be expensive tanks to receive and store sewage; heavy clay land which has been ridge and furrow ploughed may have the surface brought to an uniform slope by lowering the ridges and filling in the furrows so as to prevent sewage, when applied, falling into each furrow as into a conduit, leaving the ridges comparatively bare. Such work may cost about 5*l.* per acre. Small fields may have useless hedges removed, so as to have larger areas at command. Underdraining may or may not be necessary; this must be settled after an examination of the subsoil to be dealt with. If underdraining be adopted, deep drains answer best, and these should be laid so as to extract water and admit air. Where the surface-contours will allow of interception, sewage water from drains may be turned on to the land three or four times with advantage and with a certainty of extracting more of the salts of sewage. Sewage meadows ought to be laid out on a plan similar to that adopted for water meadows. Carriers should contour the surface, at intervals apart, in proportion to the character of the soil and the slope of the surface. Where main open carriers may be considered a nuisance, as near houses, roads, or foot-walks, they may be covered conduits having cheap outlet-valves at a chain apart; carriers in the fields may be open grips formed with plough or spade, and such as to be broken up if necessary when a change of crop is made. A cheap main carrier can be formed with common agricultural drain tiles, butt-jointed, laid half in and half out of the ground; a single pipe or length of pipes can then be removed by hand at any point to allow of irrigation, and these same pipes can be readily replaced again. Where foul smells are complained of as coming from sewage-irrigated lands the causes are in the state of the sewage and in the rude mode of using it. If old and putrid

* See Appendices III. IV. V., pp. lix, lx, lxi.

sewage is stored in large tanks or is conveyed in large open ditches which are never cleaned there will be offensive taint. Fresh sewage does not give off so offensive a taint, and if conveyed at once by covered conduits to land, all nuisance ceases immediately. Cast-iron piping and hose and jet application are costly to provide and expensive to manipulate. If they are adopted, some special reason must have been urged to warrant this form of extra outlay, as for lawns and fields near houses, or for gardens. The produce from properly irrigated land will be from five to tenfold that of the same land under ordinary cultivation. Sewage evenly and regularly applied to the growth of Italian rye-grass, on any soil, will produce from 30 to 60 tons weight of green grass on each statute acre per annum. The celebrated Craigentinny meadows near Edinburgh, principally sea sand, have produced from 40 to 60 tons per annum to each acre, and let by auction at rents varying from 25*l.* to 35*l.* the acre. At South Norwood and at Worthing clay land out of which bricks are made is irrigated with town sewage, and produces from 40 to 50 tons of Italian rye-grass to each acre. In neither case is the land underdrained, and Mr. Marriage, of Croydon, prefers to irrigate without draining. We would by no means be understood to undervalue the advantage of draining claylands in general. Sewage irrigation may be carried on throughout the entire year, and grass may be cut at Christmas. In early spring, and weeks before ordinary cultivation will produce green crops fit to cut, from four to five tons per acre may be got from sewaged land. At such times the grass sells at 15*s.* and 20*s.* per ton on the field. Six or seven crops of grass may be cut during the year, but until the watercloset system be more efficiently carried out than we found it in the towns of the West Riding, the full advantage of this mode of sewage application will not be realized.

It has been asserted that sewage-grown grass is unwholesome, and will not make good hay. The grass is, however, not only wholesome, but cows fed upon it give richer milk from which first-class butter may be made. The chemist proves by careful analysis that both milk and butter are better than samples produced from the same land in its ordinary state of meadow. Hay made from sewage-grown grass is also sweet and nutritious if properly got, but there is great difficulty in fully drying it during ordinary seasons.

When a limited quantity of sewage or other water containing manure soaks into a fertile soil, the first effect is to displace part of the water already contained in the soil, occupying its place in the interstices, whence the organic matter it contains is held in temporary union with the active soil, to be afterwards absorbed by the roots of plants or decomposed by the air, so that in a short time, varying according to the activity of vegetation and of decomposition, no impurity whatever remains. If then the sewage which has soaked into the soil is not displaced by other water until a sufficient time for it to be purified has elapsed, it will when displaced be as pure as ordinary shallow spring water. If it be found that the depth of the active soil effecting this change is about half a yard, and that it contains about one fifth of its weight of water, a quantity of sewage may sink into it equal to about 500 tons or a depth of five inches, before the water previously in the soil within 18 inches of the surface is all displaced; and if considerably less than this proportion of sewage, say one to two inches in depth, be put on rich soil at once, though the drains from it will run freely, as they do after heavy rain, they will be carrying away the water previously in the soil, and not, as is often supposed, that just poured upon it, which may with good management be retained in the soil until it in its turn becomes completely purified; and the water passing from the deep drains of irrigated land not over-manured may be as pure as that from the shallow springs of such land, all that is necessary for this result being that considerably less water be added to the soil at once than it previously contains, and that excessive manuring be avoided. During rapid vegetation an additional purification of the sewage matter takes place from actual contact with the growing plants on the surface.

The area of land in proportion to population for sewage irrigation will vary. If the object be to clarify sewage on the least area, irrespective of obtaining the greatest weight of produce or the highest standard of purification, subsoils of sand or of gravel answer best; such land acts as a filter, absorbing large volumes of sewage, the water flowing through the subsoil; but this mode of dealing with excessive quantities of sewage on permeable soil is not to be recommended where there are wells or streams to be tainted. On poor land from 5,000 to 20,000 tons of sewage per acre per annum may be so filtered, whereas on good land, where paying crops and perfect purification are looked for, 6,000 tons per acre per annum is as much as can be profitably applied. One hundred tons of sewage represents about one inch in depth

over one acre; and so in the same proportion for less or greater volumes. Where sewage is regularly and evenly applied over properly prepared surfaces, and the effluent water is as evenly and regularly removed, the surface is not turned into a swamp. In the neighbourhood of Edinburgh 70,000 and even 120,000 tons of sewage are said to have been floated over each Scotch acre of the sea sand without such result. There must be impeded surface and subsoil drainage, causing stagnation and saturation, to produce a swamp; ordinary rainfall can do it without any sewage being added. All natural bogs, marshes, and swamps are caused by water impeded in its flow and retained stagnant in the subsoil and on the surface. There are hundreds of thousands of acres in the river valleys of England, at elevations from a few feet to several hundred feet above the sea, which are swamps because arterial outlets and land drainage are neglected. If sewage irrigation produces a swamp in any case, it will be through faulty laying out of the land, deficient subsoil and surface drainage, and bad management generally, rather than in the volume of sewage applied.

Civilization in its arrangements and necessities may be compared to a machine. A rude and simple machine works well under the management of a peasant, but as it becomes more complex in construction, more delicate in its parts, more refined in its operations, so, in like proportion, must those to whose hands its working is entrusted be more and more specially educated, skilful, and attentive. Modern civilization in Great Britain abstracts population from the country to aggregate it in towns, and this has gone on during the last half century, with an ever increasing speed. Cities and towns in mediæval times had little in the way of sanitary works to be kept in order. There were no sewers or drains; pavements in streets were rude, and their cleansing was neglected; excrements and garbage were cast forth into the public ways, to be washed by rain into mud or dried into dust by sun, as the seasons favoured one action or the other. At all times the public health was deteriorated by the accumulated and neglected filth, and when several seasons of bad weather followed each other, ordinary fevers ripened up into sweating sickness, putrid typhus, and plague. The rude municipal machine of mediæval times, jolted to destruction. General district rates had not been invented, because there were no district works to keep in order, as the old Saxon law inculcated individual action or expended its powers in enforcing monopolist restrictions. A large modern town may be compared to a large modern mill or factory which is built story above story, each room being full of machines, complex in design, delicate in their parts, and requiring specially educated and skilled labour successfully to manipulate and work them. In a modern town there are main sewers and house drains, waterworks and gasworks, each interlacing streets, courts, and yards, with mains and branch-pipes; then there are surface pavements, channels, and foot walks to keep in order and to cleanse. Sewage poured into the nearest stream pollutes the water, and cesspits crowded amidst houses breed fever. If all cesspits are abolished in favour of the watercloset system there will be more sewage to contend with, and if this is to do the least injury and the greatest good, it must be used unceasingly in irrigation. Waterworks, gasworks, sewers, drains, and street pavements, to be of the greatest service, must not only be skilfully designed and executed, but they must be intelligently managed; and as with the working machine of refined and complicated parts there must be care and skilful management, so in like manner complicated sanitary arrangements in towns require the attention of specially educated men. Local self governors do not always recognise this necessity; and by attempting to work with uneducated and underpaid labour they bring discredit on their local works. If arrangements for the prevention of river pollution be added to the other duties of a local surveyor, the sanitary machine to be kept in order will be more complex. As neglect in mediæval times allowed all the terrible diseases incident to town populations to ripen up into devastating plague, so imperfect sanitary works and regulations in towns at the present day allow excessive rates of mortality to prevail, as set forth weekly, quarterly, and annually in the Registrar General's report. In this report we have shown that abuse and neglect of running waters and rivers has begun most seriously and injuriously to affect trade, both by spoiling the running waters for further uses, and blocking rivers so as to cause destructive floodings. These growing evils can only be diminished by wisely devised works and regulations. A complicated and delicate piece of machinery can only perform the work it was designed for when in perfect order and under perfect management. Sanitary works and arrangements in towns, and especially in manufacturing towns, will only produce beneficial results under skilful superintendence unceasingly applied. It will be in vain to multiply preventive works and establish new regulations unless they are managed and maintained with the necessary skill and care.

Woollen and Worsted Trade, Description, and Statistics.

A glance at table D of the interesting and valuable returns (pages xviii, xix.) will inform the reader that woollen and worsted products to the extent of 384,200,000 pounds in weight, and of a value of 64,400,000*l.* sterling are annually sent out of the mills of Great Britain.

The West Riding of Yorkshire is not the only district in which this vast industry is located, but it may safely be taken that from one-half to two-thirds of the woollen and worsted trade is carried on there.

This trade is of ancient date in England. The Romans had weaving establishments of woollen cloth at Winchester, where the copious springs from chalk afforded means both for power and for washing and dyeing. The mother of Alfred the Great is recorded to have been skilled in spinning wool. Flemish woollen weavers settled in England about the time of the Norman Conquest, and continued immigration of woollen weavers from Flanders took place in the reigns of Henry I., Henry III., Edward I., and Edward III. The woollen tissues first spun and woven at Worsted, in Norfolk, about the year 1388, became the staple trade of Norwich. Devonshire manufactured woollens soon after the introduction of the trade into England, and Worcestershire a little later. Friezes were also early manufactured in Wales. In the middle of the sixteenth century, Berkshire took the lead in woollen manufacture.

About the middle of the last century the West Riding of Yorkshire became the seat of the Worsted and Woollen trades. Halifax began to be specially noted for Kerseys. From about this date, these trades finding so much water available not only for power but also for washing, dyeing, scouring, fulling, and all other purposes, the Yorkshire manufacturers and traders were enabled to undersell those of other places.

The rivers Aire and Calder were made navigable by Act of Parliament about the year 1698, and have from time to time been improved so as to meet and supply the requirements of a growing trade. This navigation has such advantages, and has been so ably managed up to this date, that it successfully competes with the established railways.

It is of the utmost importance to study the rise, progress, and condition of any manufacture, especially if it has changed its locality. Successful trade is generally contingent upon local natural advantages which forethought and care may improve, or which continued abuse may deteriorate and even ultimately destroy. The West Riding of Yorkshire, and especially the Aire and Calder district, possesses many natural advantages favourable to the establishment and conduct of trades requiring good water. A range of mountains, composed principally of Scar limestone and Yoredale rocks, capped with Millstone grit, forms the western boundary, and sends down numerous spring-fed rivulets and streams to wind and flow over the entire breadth of this portion of the county. The graduated fall affords means of obtaining water-power, and the numerous valleys offer favourable sites for storage reservoirs. The vast numbers of mills and dyeworks (upwards of 5,000) established since the commencement of the present century, and the rapid growth of the worsted and woollen trades of the West Riding, clearly indicate that the natural advantages of this part of Yorkshire are great. There are not only spring and river water, but there is also cheap fuel obtained from the local coal-field, enabling the manufacturers to supplement water-power with steam, and, in numerous instances, to obtain all the power required from steam alone. Abuses in the district by throwing solids into running waters and by pollution have, however, become in some cases destructive to trade, and in numerous cases prohibitive to further extensions. Some branches of trade having migrated to Scotland where water less polluted is obtainable.

The various processes to which water is put in cleansing wool and in manufacturing Woollens and Worsteds may be stated as under:

1. Scouring the wool with a ley and hot water, to remove grease and dirt.
2. Washing with clean cold water.
3. Dyeing, when the cloth is to be wool-dyed.
4. Scouring cloth with fuller's earth to remove oil and size.
5. Dyeing, when piece-dyed.
6. Milling or fulling, with soap and warm water, either in the fulling-stocks or in the improved milling machines, where the cloth is squeezed between rollers.
7. Scouring, to remove the soap.
8. Boiling cloth to give it a permanent face.
9. Steaming, to take away the liability of the finished cloth to spot.

Dirty water may be used for power, but even for such purpose it is a nuisance, and, for washing and dyeing, water may be so polluted as to be injurious even to dark and coarse goods, and totally unfitted for cleansing and dyeing fine fabrics.

The vast interests involved in the Wool, Woollen, and Worsted trades of Great Britain are set forth in the following Statistical Tables kindly furnished to the Commission by Mr. Jacob Behrens, vice-president of the Chamber of Commerce of Bradford.

Table A.

Estimate of the Produce of Wool in the United Kingdom, from 25,795,708 Sheep based upon a Return made for Great Britain on the 5th March 1866, and for Ireland in 1865.

Mem.—The number of sheep in Ireland under one year old is supposed to bear the same proportion to the whole number as that given in the Return for Great Britain.

——	Number of Sheep.		Weight per Fleece.	Wool produced.
	Under one year old.	One year old and above.		lbs.
In England -	4,505,345	10,620,196	6½ lb.	69,031,274
„ Wales - -	380,854	1,287,809	5½ „	7,082,250
„ Scotland -	1,624,638	3,630,439	6½ „	23,597,853
„ Ireland - -	1,048,491	2,640,251	6 „	15,841,506
Isle of Man & Channel Islands	24,410	33,196	6½ „	215,774
	7,583,817	18,211,891		
Under one year old Hoggets -	5,583,817		6 „	33,503,293
Lambs killed and clipped.	1,000,000		3 „	3,000,000
Lambs killed and not clipped.	1,000,000		0 „	0
				152,272,650

Table B.

Estimate of the Quantity and Value of Wool and similar material worked up in Worsted and Woollens.

Mem.—Import, Exports, and Values from Board of Trade Tables for 1864, except quantity of English Wool, for which see A.

——	Produce and Imports.	Exports.	Retained for Home Consumption.	Price per lb.	Value. £
English Wool -	152,272,650	7,320,299	144,952,351	2/4½*d.*	17,213,075
Foreign „ -	206,473,045	55,993,803	150,539,242	1/6½*d.*	11,123,905
Goats' Hair or Wool	4,737,330		4,737,330	2/8½*d.*	650,191
Home-made Shoddy	52,000,000		52,000,000	5*d.*	1,083,334
Imported Shoddy -	22,482,880		22,482,880	4¾*d.*	494,611
Wool Extracts -	5,000,000		5,000,003	6*d.*	125,000
Foreign Yarn -	4,479,984		4,479,984	4/6*d.*	1,008,004
	447,445,889	63,254,102	384,191,787		£31,698,120

Table C.

The Exports of Wools, Tissues, and Yarns, and the Quantity of Foreign Wool worked up in the years 1844, 1854, and 1864.

	—	1844.	1854.	1864.
Exports of English Wools - -	£	535,134	734,490	673,446
Do. Worsted Yarns - -	£	958,217	1,557,459	5,417,377
Do. Wool Tissues - -	£	8,204,836	9,121,186	18,533,457
Do. British produce - -	£	50,642,306	97,092,308	160,449,053
Foreign Wool retained for Home Consumption.	lbs.	63,741,087	81,654,711	155,276,572

Comparative Per-centage of the Exports of Worsted and Woollen Manufacturers to the other textile fabrics in 1864.

Exports of Worsteds -	£ 16,217,898	17½ per cent.	16 per cent.
Do. Woollens -	7,732,976	8½ „	
Do. Cottons - -	54,882,329	59 „	
Do. Linen and Jute	11,636,049	12½ „	
Do. Silks - -	2,274,927	2½ „	
Totals - -	£ 92,744,179	100 per cent.	
Total Exports of British produce.	£160,449,053		

Table D.

Estimate of the Value and Weight of Wool and similar material manufactured into Worsted and Woollen Yarns and Tissues in the United Kingdom 1864.

35,000,000 lbs.	English Wool exported as yarns -	-	- Value	£ 5,500,000
110,000,000 „	do. manufactured into tissues	4/	- „	22,000,000
150,500,000 „	Foreign do. „ „ „	3/	- „	22,600,000
4,700,000 „	Mohair do. „ „ „	5/	- „	1,200,000
4,500,000 „	Foreign yarn „ „ „	8/	- „	1,800,000
79,500,000 „	Shoddy and extracts „ „	1/	- „	4,000,000
	Cotton, yarn, and other material -		- „	7,300,000
384,200,000 lbs.				£ 64,400,000

Table E.

Estimate of the Value and Weight in 1864 of the Wool and similar material worked up with it into Worsted and Woollens for Export and Home Consumption.

Mem.—In this Estimate all English Wool is considered as worked up into Worsted, and that which is worked up into Woollens is supposed to be more than balanced by the Foreign Wool (Russian, Australian and others) in Worsteds.

WORSTEDS.

Exports.

£ 5,417,377	Yarns (31,824,296 lbs.) equal in Wool to - - - -				35,000,000 lbs.
7,945,633	Goods ¼th mixed with other material £6,000,000	Wool	-	4/	30,000,000 „
2,852,815	Do. all Wool - - - - - -		-	4/	14,000,000 „

Home.

13,200,000	Do. mostly mixed with other material - - -			4/	66,000,000 „
1,200,000	Do. of Mohair „ „ - - - -			5/	4,700,000 „
2,984,175	Cotton and other material worked up with the above exclusive of exports - - - - - - - -				
£ 33,600,000					149,700,000 lbs.

WOOLLENS.

Exports.

£ 1,186,815	Goods mixed with ¼th of other material	£ 890,000	1/	18,000,000 lbs.
6,546,161	Do. all Wool (foreign)	- - - - -	3/	43,500,000 „

Home.

16,000,000	Do. of Foreign Wool - - - - -		3/	107,000,000 „
1,800,000	Do. do. Yarns - - - - -		8/	4,500,000 „
3,200,000	Do. Shoddy and Extract - - - -		1/	61,500,000 „
2,067,024	Cotton and other material mixed with Wool.			
£ 30,800,000				234,500,300 lbs.

Under the name of Shoddy, which occurs so conspicuously in the foregoing tables, an enormous weight of material is used which until recently was waste. Shoddy was first introduced into use about the year 1813, at Batley, near Dewsbury. Mungo was adopted in the same district but at a later period. Shoddy is the produce of soft woollen rags, such as old worn-out carpets, flannels, guernseys, stockings, and similar fabrics. "Mungo" is the produce of worn-out broad or similar cloths of fine quality, as also of the shreds and clippings of cloth. It was stated at our inquiry that the term arose in consequence of the difficulty at first of manipulation. A manufacturer gave some of the materials to his foreman, who, after trial in the shoddy machines, came back with the remark, "It winna go," when the master exclaimed, "But it mun go." These woollen rags are collected, packed in bales, and are imported from Russia, Egypt, Turkey, the entire area of Europe, India, China, and, in fact, from all parts of the world where woollen garments are worn and rags are produced and can be collected. They come to Yorkshire from districts where plague, fever, smallpox, and loathsome skin diseases extensively prevail. The bales are opened and the rags are sorted by human fingers before being placed in machines which break up, tear, separate, and cleanse the fibre for manufacturing uses. According to the evidence we obtained no disease has ever broken out amongst the persons who so manipulate these old woollen rags, although in many of the countries in which they are collected they are believed to be peculiarly plague-bearing materials. The lapse of time in collecting, storing, and transmitting these rags, as also the possible destruction of any special poisons by friction or otherwise, must be taken into account. The whole of the facts deserve, however, the serious attention of those persons who insist that the power of communicating disease is contained in a dangerous manner by woollen goods which have been worn by persons suffering from contagious diseases. The experience obtained by the manipulation of shoddy for upwards of 50 years proves that old woollen rags are not in any degree dangerous to the health of those who work amongst them.

The shoddy trade, as now carried on in the West Riding, is a remarkable instance of the utilization of waste material. The term "shoddy" was, in the first instance, one of reproach, but this has ceased to be. Shoddy now enters into honourable companionship in official returns with British and foreign wools, mohair, silk, and cotton, and is used by manufacturers throughout the woollen and worste ddistricts. By recent returns (1866) the total weight of wool and goat's hair of home and foreign growth used, was about 310 millions of pounds; the total weight of shoddy and extracts for the same period was about 74½ millions of pounds, or some 33¾ thousand tons, so that shoddy now forms near one-fifth by weight of the woollen and worsted manufacture of the district. The woollen trade of Great Britain could not be carried on to its present extent without shoddy.

Shoddy is mixed with wool in proportions from one-third to two-thirds shoddy or mungo, and is used in the manufacture of cheap broadcloths, finer cloths for ladies' capes and mantles, pilots, witneys, flushings, friezes, petershams, duffels, honleys, paddings, linings, cloths used for rough and loose great coats, office coats and trousers, pea-jackets, and blankets. A considerable quantity is used in the form of flocks for beds. Felted cloth is extensively manufactured; it dispenses with spinning and weaving, depending on the felting property of wool by reason of the curl in the fibre. The process is carried on by the aid of warm moisture, pressure, and milling; such cloth is used for table covers, horse cloths, carpets, paddings, druggets, and the coarser and thicker kinds for covering steam-boilers, steam-pipes, and ship's bottoms beneath the copper. Some of the finer and better class of felted cloths are printed.

The manufacture of shoddy and mungo need not produce any special pollution.

The rags are torn into fibre by machines specially prepared, and the dirt, dust, and fine particles of wool are blown out in such manner that this refuse can be collected and sold for manure. About one seventh by weight of shoddy is so cleansed out as waste in preparing it. The price obtained for it as manure varies from 10*s.* to 20*s.* per ton. Some of the richer sort of waste shoddy is sent into Kent as a dressing for hop-growing.

Pollution by Manufactures.

It has already been stated that, although the introduction and perfection of the steam-engine in the last century has enabled woollen manufacturers to dispense in great measure with water *as a source of power*, they are still absolutely dependent upon an abundant and tolerably pure supply of this element for the successful prosecution of their business. Indeed, mechanical power is now—thanks to steam—only a question of expense, and can be had at all times and anywhere by paying for it in the shape of fuel. In this respect the manufacturer is no longer so circumscribed in his choice of a site for his operations as he was formerly. But water, abundant and good, is only to be had within limits which are fixed rather by nature than by any efforts of man; without it the woollen trade would be impossible, and, although much may be done by combination to bring water from a distance for the use of manufacturers, its cost when so supplied is a heavy tax upon the woollen industry, and places the manufacturer at a disadvantage in the market as compared with those who derive their water from natural and readily accessible sources. If at this present time and with the full advantage derivable from steam power the woollen and worsted trade was to be established for the first time in England, the West Riding of Yorkshire, with its streams of bright pure soft water, and its productive coal-fields, would be, as it has been, the chosen site of this manufacture. But as old age, decay, and death in a plant or animal is the natural result of wear and tear of the vital processes, so it would seem that the successful prosecution of woollen manufactures is certainly, if slowly, leading to their destruction or removal from their ancient and favoured haunts, if some effort be not made to arrest the progress of pollution of which they themselves are the chief cause. In the two facts, first, that in one year (1864, Table D.) 384,000,000 pounds of wool were worked up into various tissues in Great Britain, and secondly, that every pound of this wool has to undergo operations necessitating the use of large volumes of water, and rendering that water foul and offensive, we have the history of all rivers on which the woollen trade is located, and notably of the Aire and Calder.

These rivers are indeed subject in common with those flowing through agricultural districts (as the Thames and Lee) to pollution from sewage, from tanneries, breweries, malting and other ordinary trades, and from exceptional manufactures, such as paper making, &c., but beyond all doubt their characteristic peculiarity is that derived from the different processes incidental to the worsted and woollen trade. To those who are familiar with the West Riding of Yorkshire it may seem unnecessary to describe the condition of the rivers which form the subject of this report, and yet it may well be doubted whether that very familiarity may not have rendered them all but unconscious of a state of visible pollution which strikes a stranger from the non-manufacturing districts with astonishment.

Moreover it is certain that very few persons even in the district possess an intimate knowledge of the causes of this pollution or can estimate their individual influence on the general result.

With very few exceptions the streams of the West Riding of Yorkshire run with a liquid which has more the appearance of ink than of water.

In the higher part of the country as is shown, in another part of this report, the water is of the purest description, but as it arrives at any point where conditions for the establishment of a woollen mill are sufficiently favourable, so does the character of the water commence to deteriorate, becoming fouler and more foul after leaving each successive mill, till as has been abundantly shown by the evidence, the stream has to be abandoned as a source of water either for domestic supply or for manufacturing purposes, (otherwise than furnishing power) and is looked upon and treated as little better than an open drain.

In order that we may learn to what extent and by what means a state of things so baneful alike to the towns and the country, to the manufacturer and the operative, the landed proprietor and the peasant, may be remedied, it is necessary to describe

in some detail the different stages of the treatments of wool, and the dyeing and cleansing of fabrics as practised in the mills of the district.

*Wool Washing.**—The first process giving rise to pollution is that of washing the wool. The object of the washing is to remove ordinary dirt and the natural grease, as well as that which has been applied to the fleece, and to open the wool to the action of the dye.

The wool is immersed in a copper filled with stale human urine, diluted with water and heated by steam. In this bath it remains for a time varying from half an hour to two hours, when it is laid upon a grating placed over the copper to drain, and then removed to another vessel to be washed with cold water.

The action of stale urine probably depends upon the presence of free ammonia or its carbonate. Pigs' dung is sometimes employed instead of or in combination with the urine. Other substances, such as soda-ash, phosphate of soda, and salts of ammonia, are sometimes substituted or added to this bath, but the favourite material seems to be stale human urine.

The wool, after being drained, is washed in cold water. In the smaller mills this is performed by stirring up the wool in a tank of water with a strong pole, the water being let off through a "clow" or shuttle, furnished with a grating, at the bottom of the vat, which is again filled with cold water, the water being renewed several times in succession.

In late years a machine known as Petrie's wool-washing machine has been introduced. The wool, steeped as before, is here immersed in water contained in long tanks, and is made to pass forwards, being at the same time opened out by an ingenious arrangement of rakes worked by machinery. The principle in this case is to introduce the wool to liquid which is already fouled by having passed over a first portion, and so gradually to bring it into contact with clean water at the other end.

Three or four of these vessels are placed in series, and the wool is transferred from one to the other by endless bands of wire gauze.

The wool is put into a tank from which the waste water flows away, and issues from the tank to which the clean water is supplied. The use of this machine offers an opportunity of economizing water, which is of great advantage when the supply is limited, and as it appears to work effectually, its more general introduction would probably be of benefit in diminishing the quantity of foul water to be dealt with.

This "scour" water runs in either case from the vats to the nearest outfall. There is nothing in it that is considered worth saving, and we have not heard of its ever having been turned to account, or treated in any way. It will be easily conceived that the first of the "scour" is a most offensive liquid. In the case of the old, and still generally practised, method of hand-washing, the liquid differs very much at different periods of the process; the first vats let-off being very foul, whilst the last portions are nearly clean water.

In washing by machine the whole of the water will necessarily be of one character, more diluted than the first water from the old process and less so than the latter quantities, but as a whole equally objectionable.

The discharge into rivers of large quantities of water in which dirty wool has been steeped would be bad enough, even if water alone were used, but the nature of the filthy liquid which is actually employed makes it thoroughly disgusting.

The first portions of the washings are a yellowish glutinous stinking liquid, and this, as we have said, is passed into the rivers. If the wool is not to be dyed, or is to be removed from the premises for that purpose, or if it is to be woven before being dyed, it is dried in hot chambers of various constructions; but this part of the process is not productive of any nuisance or pollution.

Wool Dyeing.—The dyeing process is the second source of pollution from the woollen manufacture.

It would be out of place in this Report, even if it were practicable, to enter into a lengthened account of all the different processes of dyeing different colours as practised in the mills of the West Riding of Yorkshire, or even to enumerate the different materials which are employed. Every shade of colour, every form of fabric in woollen has its representative here, and it would require volumes of print to describe them even cursorily. One case, however, may be sufficient to illustrate the

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* See Appendix No. VI., p. lxi.

whole, and the best to select, because the simplest and that which leads to the greatest amount of pollution, is probably that of dyeing black goods.

It should, however, be stated that two forms of dyeing are practised which respectively produce modifications of the refuse materials.

The one is the dyeing *in the wool* (whence the goods are called *wool-dyed*), the other dyeing *in the piece*, that is to say after the cloth is woven. In this latter case the goods are called *piece* (or *stuff*) *dyed*.

We shall describe the process of dyeing in the wool.

The materials used in dyeing black, omitting indigo, are several different woods, such as logwood, barwood, camwood, peachwood, fustic, and various salts, principally copperas or sulphate of iron, alum, "argol," or crude bitartrate of potash; to these must be added, as inventions of a later date, "chrome," or bichromate of potash.

Every dyer may be said to have his own particular method of treating the wool; we do not pretend to give a description which shall be absolutely true of any one case, but in general the following may be taken as an outline of logwood-dyeing, *without* chrome.

A quantity of washed wool, say 200 lbs. is put into an iron vat or cistern holding from 700 to 1,000 gallons of acid liquid made by boiling camwood and barwood with a certain quantity of "argol" and alum; by this process, which is called "souring," a certain pink colour is given to the wool, and it is prepared for subsequent treatment by logwood. After boiling for two hours the acid liquid is let off from the bottom of the cistern by a valve or tap furnished with a grating, and the wool having been removed, the vessel is again filled up with water. Bags of logwood, reduced to the condition of sawdust, are now suspended in the liquor from a pole placed across the vat so that a clear extract may be obtained. A certain quantity of alum and argol is again added. When the soluble parts of the logwood are supposed to be dissolved in the water the bags of exhausted wood are removed, and the wool, which has been "soured" by the last process, is put into the vat. The whole is now kept at the boil for two or three hours, at the end of which time the copperas, dissolved in a small quantity of water, is added. The boiling is continued for some time longer, and, the fire being withdrawn, the whole is allowed to cool down to about 100° Fahrenheit, when the valve is opened and the waste liquid allowed to flow away.

This waste liquid is the great and chief source of pollution of the rivers, so far at least as their appearance is concerned. We shall return to it presently.

The dyed wool is now removed to a heated chamber or stove, to be dried. When dried, it is beaten or "scrabbled" in a machine, through which a current of air is made to pass so as to blow away any portion of dye-material adhering to it, and short pieces of wool unfit for weaving.

It is not proposed to describe the different mechanical treatment through which the wool is passed in the manufacture of cloth, but it is necessary to state that before it can be made into yarn it requires to be softened by being abundantly greased, and for this purpose large quantities of the finest olive oil are consumed. Another point to remember is, that in the machines there is always produced a rather large quantity of waste wool, which contains a high per-centage of oil. The cloth when made is subject to two other principal processes; one being that of "milling" or "fulling," and the other of washing.

The first of these is mechanical. Its object is by beating the cloth with heavy wooden beaters to spread out the fibres and fill up the interstices of the fabric so that its texture may become close and even; hence probably the term "fulling." This part of the process is carried on in contact with water, and soap is generally, though not always, used at the same time.

The washing process consists of passing the cloth many times through soap and water, and finally through fresh portions of water until all soluble matter is removed. The soap removes from the cloth the oil employed in working it, and all that part of the dyeing materials simply adhering to and not fixed in the cloth.

We have from this point no further interest with the cloth thus manufactured, which is dried, prepared, and sent to market.

It will be seen that the stages in the manufacture of black cloth at which liquid refuse is produced are:—

1. The washing or "scouring" of the wool.
2. The discharge of waste liquid from the dye-vats.
3. The discharge of soapy and coloured liquid from the fulling and washing process.

It is necessary to a proper understanding of the subject that these operations should be considered separately in some detail.

1st. It has already been stated that the wool is washed in stale urine and water, and then washed in ordinary water till the latter runs away clear. We have not found it easy to get at the exact quantities of water used in this process.

Mr. Henry Brooke, of Bradley Mills, Huddersfield, states, that about half a ton of water is used to 50 lbs. of wool in each washing, of which there are two or more; but, he adds, "there is a great difference. Some people use much more water than others."

Some returns lately made to us on this point give such divergent quantities for the water used in washing the wool that the only conclusion at which we have been able to arrive is that in all cases these quantities are very considerable.

2nd. The discharge of liquid waste from the dye-vats.

It may be taken for granted that each of the substances named as being used in dyeing black serves some purpose,—in heightening the colour, or rendering it more permanent; but essentially the black is produced by the action of the salt of iron (copperas) on the colouring matter of the logwood.

If we take a filtered infusion of logwood, and add to it a solution of sulphate of iron, a black colour is produced, and the black matter is solid and in suspension; that this is so can be seen by allowing the mixture to stand for a few hours, when the upper layers of the liquid will be entirely free from black matter. It is of the highest importance that a right understanding should be had of this subject, for upon it depends any hope that may be entertained of purifying the rivers of Yorkshire from the dye refuse. The black dyeing of wool depends upon fixing in its pores an insoluble compound of the colouring matter of logwood with iron. When the copperas is added to the boiling logwood liquid the formation of this product takes place, both in the wool and *outside of it in the liquid;* that which is formed in the wool, being insoluble, remains in the fibre, and cannot be removed by any subsequent washing.

But by far the greater part of the black precipitate is formed in the liquor itself; and it is this, and not any portion of spent dye-woods, which constitutes the blackness of the stream issuing from mills when the dye-vats are discharged.

If a quantity of the black liquid is filtered it will be found that what remains on the filter is a compound of the vegetable matter of the dye and oxide of iron; in the solution will also be found a large quantity of the salt of iron, which is used in excess.

It is difficult to form an accurate estimate of the quantity of this black suspended matter.

The results of several experiments give the quantity in 1,000 gallons at from 50 to 150 lbs. when dry.

There can be no question, as has been before mentioned, that it is to this material that the black appearance of the rivers is chiefly due. Its discharge in enormous quantities helps to silt up the stream and the mill goits. If it could be kept out of the streams they would be *comparatively* clean.

Very few attempts have been made to cleanse the dye-water before discharge into the rivers. Mr. Ripley of Bradford describes a plan adopted at his mills for arresting a portion of the dye refuse by means of subsiding reservoirs, but as he subsequently flushes out the deposit into the stream this system is simply, so far as the river is concerned, the conversion of a daily and regular into an intermittent and periodical fouling of the stream.

Mr. Townend, of Cullingworth, speaks of having very successfully dealt with dye-water by filtration through beds of ashes; but the dyeing operations at his mill are not on a large scale, and this method would not be available at many works.

It has been stated that the black dye-water will deposit and become clear on standing; but this change is very slow, and to cleanse dye-water in this way would be difficult in some cases, without extensive subsiding reservoirs.

Experiments in the laboratory prove, however, that the precipitation of black dye-water is readily practicable by chemical means. The black liquor discharged from the dye-vats is, as before said, a solution of sulphate of iron, in which insoluble dye is suspended. The addition of a little lime neutralizes the acid of the iron salt, and produces a flocculent precipitate which carries down with it the finely divided black matter. The action is rapid and complete, and in a few minutes the liquid becomes clear and nearly colourless. The quantity of lime required for the purpose does not exceed 10 lbs. to each 1,000 gallons of dye-water. The expense is therefore incon-

siderable. By the use of properly constructed precipitating tanks it would be quite practicable to purify by this means the dye-water of the largest works. The clear liquid might be run off from the precipitated matter, and the latter, after draining, might be pumped or dug out of the tank, and set in heaps to drain.

The ready separation of the black dye-stuff from the water has appeared to us so important that we have taken into consideration every means by which it might be accomplished. The problem is the separation day by day of the solid matter in such form that it may be preserved, if of any value, or, if not worth preserving, be readily burnt or got rid of otherwise than by passing it into the rivers.

A form of mechanical filter which has been found very valuable in several manufactures early attracted our attention. It is a patented invention known as Needham's press, consisting of a number of narrow chambers lined with linen or calico, into which the liquid to be filtered is driven by a small force-pump. The liquid passes clear through the bags, whilst the solid portions are arrested. This action is maintained with low pressure until the chambers begin to be filled with solid residue, when it is necessary to increase the pressure. The machine is extensively used in the Potteries for the separation of clay from water in which it has been washed; it is also successfully adopted in papermaking, in breweries, and some other manufactures.

The thin mixture of clay and water known as "slip" was formerly dried on hot plates till it became fit for working. In many potteries the mixture is now pumped into Needham's machine under great pressure, and when the operation is complete the clay is taken out in solid cakes, which are strong enough to be readily handled and fit for the use of the potter.

By the kindness of Mr. Henry Brooke, and under the superintendence and at the expense of Mr. Needham, one of these presses was fitted up in the dye-house at Bradley Mills near Huddersfield, and experiments were made from day to day in the filtration of black dye. These trials were very satisfactory to us, as showing that it is perfectly practicable to separate from the dye-waste the most objectionable portion, and to discharge into the rivers a liquid comparatively pure.

The greater or less absence of colour in the filtered liquid depends upon the due adjustment of the lime, which is readily arrived at after a few trials. It is quite possible by this treatment to filter from the dye waste a liquid as bright and colourless as the water of ordinary rivers not contaminated by manufacturing refuse. On the occasion of a public exhibition of this process which was made at Bradley Mills in March and April 1867 samples of this water were taken, analysed, and found to contain in a gallon—

	March 27.	April 4.
Organic matter - - -	2·56	3·12
Mineral do. - - -	32·94	34·33
Total solid contents - - -	35·50	37·45
Hardness in degrees of Clarke - -	14·4	18·60

Many waters of rivers are less pure than was this sample of chemically treated dye-water.

The machine actually employed at Bradley Mills, although only about 7 feet square by 3 feet in height, had a filtering area of 240 feet, and by it we were enabled to cleanse from 700 to 1,000 gallons of limed black dye-waste in an hour. The tank in which the dye-water was precipitated was capable of holding from 2,500 to 3,000 gallons, and was calculated for the treatment of from one to two day's discharge. Mr. Brooke considered that this tank and machine would enable him to purify all the dye-refuse produced at his mill before discharge into the river. With regard to the solid material which is found in the cloths when the machine is taken to pieces, this substance is, as has been already explained, a combination of oxide of iron and vegetable matter. It is not difficult to dispose of it when taken from the press. It is similar to damp sawdust, and may be got rid of by mixing it with small coal, and burning it under the furnaces; better still is it to allow the material to dry up (which from its light porous nature it readily does), and then to set fire to it; it burns like a slow match, without flame, but so persistently that a heap once alight will burn till all the vegetable matter is consumed. There remains, after combustion, a red powder which is almost

entirely oxide of iron. It forms from $\frac{1}{5}$th to $\frac{1}{4}$th the weight of the black stuff, and would undoubtedly find a market, either to be made into red or chocolate paint for external ironwork, or to be used in the purification of gas, or for conversion into perchloride of iron for purposes of deodorization.

It is impossible at present to say to what other purpose this black solid residue from the dye-wastes might be put. From the quantity of oxide of iron which it contains, and from its porous character, it acts, we find, as an excellent deodorizer, and would probably be eminently useful in some cases where charcoal would be employed. This peculiarity can also be taken advantage of in the treatment of the putrid scour water before mentioned. It was found impossible to filter this foul liquid in its natural state through Needham's press. When, however, a quantity of the black precipitate was mixed with it, the putrid smell was removed, and the liquid filtered became bright and colourless. In practice it is easy to take advantage of this property in the treatment of the scour-water, and thus to make one source of pollution of the river the means of counteracting another. The scour-water may be even more readily purified by mixing it with the dye-water before precipitation; but this necessitates a far larger capacity of retaining tanks.

Before leaving this part of the subject, we think it right to say, that although we are convinced by our experience of black dye-water that it is perfectly practicable to purify it, and thus greatly to improve the condition of the river, we have no intention of dictating *how* this should be done. One manufacturer may choose to have large precipitating and subsiding tanks, and to run off the clear liquor; another may filter it through ashes; a third may see his advantage in using Needham's press, or some other contrivance for the same purpose. It is our duty to recommend that any purification of the river, which we believe reasonable and practicable, should be enforced, but it is no part of that duty to specify the precise way in which that purification should be accomplished.

At the same time there are many circumstances in favour of a mechanical method of filtration of these refuse liquids, such as that of Mr. Needham's press; chief amongst which are the small amount of space necessary for working, the production of a nearly dry and manageable product, and a perfect security that no liquid shall pass unfiltered into the rivers.

We have not had the opportunity of trying the action of the centrifugal machine in filtering dye-water, but it is worth consideration.

We would wish to impress upon those who have to deal with this subject the absolute necessity of *chemically treating* the dye-water before attempting to cleanse it, whether by subsidence or filtration. The black matter is so finely divided that it is all but impossible to separate it without such treatment, except after long standing; and long standing means great capacity of tanks and consequent difficulty and expense.

In addition to this, if the dye-water be not so treated a large quantity of salt of iron will escape in solution with the water.

The addition of lime need be neither troublesome nor expensive, and its use greatly simplifies the problem of treating the refuse of dye-houses.

In dealing with the refuse of black dyeing we have only treated one branch, though a very important branch of the subject. There is of course a discharge, more or less coloured, from every kind of dyeing, and the treatment must be modified accordingly.

It would be manifestly impracticable for the dyer, especially for those who are called "public dyers," that is to say, who dye goods for manufacturers, and who are therefore called upon to dye on the same day or in the same week all shades of colours, to treat the refuse from every vat separately. In this case arrangements must be made for collecting the whole of the liquids into one, and by lime or other suitable agent obtaining the best purification possible.

It is obvious that whatever difficulty or impossibility may attend the removal of *all* impurity from the refuse liquids before discharge, it is practicable and comparatively easy to arrest all suspended matter, and to keep such matter out of the river.

All the witnesses agree that it is not so much the salts dissolved in the river water that would prevent its use by them in washing and dyeing as it is the *dirt* and matter suspended in it, and which in great measure is caused by the discharge from the dyeing and washing processes.

No solid matter from dye-works should under any pretence be allowed to pass into the streams.

There will be no want of skill on the part of manufacturers or others to meet difficulties as they arise, so soon as the prohibition is made absolute.

3rd. The third stage of refuse discharge, namely, fulling and washing dyed goods, remains to be described.

After the cloth has been woven it is subjected, as has been before stated, to a process of beating, or is passed through powerful rollers, by which the fibres are flattened out; this process is called *fulling*.

The cloth is caused to pass repeatedly through vessels containing a strong solution of soap. The combined action of the beaters and the soap causes the removal of the oil which had been applied to the wool, and of those portions of the dye which have not become permanently fixed in the fibre.

Removed to another apparatus, the cloth is now washed with an abundance of water until the last portions of soapy liquid are removed.

The liquids produced are known as the "soap waters," or "soapsuds." They vary very much in character, according to the goods which have been washed, being sometimes very black, and sometimes comparatively colourless. That portion also which is discharged from the fulling machine is much thicker and fouler than the washings, and of these the first portion is the strongest, getting less and less so till the washing is complete.

Formerly, as described by several witnesses, the whole of this soap water was discharged into the rivers, and was a source of serious pollution, causing a scum and froth, and coating with slime all objects with which it came in contact.

The large quantities of soap and oil employed, however, very naturally attracted attention to the possibility of dealing with these liquids for the extraction of grease. Mr. Teall of Wakefield stated that the extraction of grease had been carried on upon a small scale for 20 years past, his own connexion with this business dating 14 years back.

There are in the principal woollen districts persons who make a business of the extraction of grease from soapsuds. Contracts are made with millowners, by which the grease-extractor secures a right to the soap liquids, in consideration either of a fixed annual payment, or of a royalty computed on the amount of grease saved, or of the quantity of soap used in the mill. In most instances the millowner gives accommodation for the carrying on of the process, and in some cases is at the expense of the necessary tanks and other plant, as well as furnishing steam where required. For the privilege of treating the soap-waste very varying sums are paid to the mill-owner, according to the extent of his operations, and consequently of the soap and oil which he uses.

We have been told of an instance in which as much as 3,000*l.* a year was received by one millowner for the concession; but this was a very exceptional case, and the amount realized is more usually from 50*l.* to 150*l.* or 200*l.* a year.

Grease Extraction.—The process of extracting grease from soapsuds is sufficiently simple, and may be described in a few words.

The soapsuds from the fulling and washing machines are allowed to flow into a tank or tanks capable of holding all that may be produced in one or more days. In some mills the whole washings are collected; but in the larger number the flow to the tank is stopped by a simple "shuttle" or valve at a given period in the process of washing; that is, when the liquid is becoming poor and so nearly approaching to clean water that the contractor does not find it worth while to collect it for treatment.

The workman having charge of the washing process usually receives from the contractor a small gratuity to induce him to attend to this. In some cases, the power of diverting the flow is at the tanks, and within the control of the contractor's own servants. The separation of the grease is effected by the addition to the soapsuds of an acid which neutralizes its alkaline character and liberates the oily acids. Sulphuric acid is usually employed for this purpose, as being most economical, but hydrochloric acid is equally effective. The quantity of acid varies according to the material to be operated upon, but as its use constitutes a considerable proportion of the expense, it may be supposed that the grease extractor is careful to avoid any unnecessary excess.

In the majority of works the liquids are treated cold, but steam is sometimes employed, under a patent process for hastening the separation of the grease.

The addition of the acid causes a change in the appearance of the soap liquid; a portion of solid matter rises to the surface, but a quantity falls as sediment to the bottom of the tank. When the separation is considered complete, the water is run off from an opening in the tank near the bottom, but above the sediment, until the greasy matter floating on the top joins the sediment. This water flows away by the ordinary drainage channels of the mill to the rivers.

The semi-solid contents of the tanks are now taken out and placed to drain in large open bags made of cocoa-nut fibre lined with coarse canvas, and here an additional quantity of water is removed; in some cases the greasy matter is mixed with sawdust to render it portable.

The drained greasy mass is further subjected to a process of pressure and heat, which results in a crude oil, which flows into barrels, a solid cake remaining in the press. The oil is distilled for the production of refined oil, stearine, &c., with which we have no concern, and the cake is sold to manure manufacturers. In Appendix No. VI., page 62, will be found the returns made to questions which were addressed to some of the principal woollen and worsted manufacturers in the West Riding on this and other similar subjects; the following table compiled from such of the answers as could be made available* will give some idea of the value of oil and soap used by the trade, and of the royalty paid for the privilege of recovering the grease.

—		Oil.	Soap.	Both.	Royalty.
		£	£	£	
Akroyd, James & Sons	Copley	250	100	350	—
Armitage, Brothers	Huddersfield	1,460	280	1,740	80
Bates, John	Dewsbury	450	260	710	—
Barker, R. H. & Co.	Wakefield	3,000	700	3,700	100
Brooke, Jas. & Sons	Huddersfield	740	214	954	30
Brooke, John & Sons	Huddersfield	2,850	580	3,430	55
Clay, Daniel	Sowerby Bridge	3,020	480	3,500	150
Crowther, Alfred	Lockwood	4,000	600	4,600	70
Crosland, Geo. & Sons	Lockwood	2,300	700	3,000	40
Howgate, Jas. & Sons	Mirfield	3,500	1,389	4,889	55
Sugden, James Bros.	Bingley	400	520	920	80
Wormald, John	Dewsbury	8,000	1,700	9,700	130
Yewdall, David & Sons	Leeds	3,500	1,000	4,500	75
Not signed; post-mark	Bradford	1,000	2,250	3,250	100
Not signed; „	Halifax	800	1,020	1,820	150
Not signed; „	Huddersfield, Shepley	4,000	200	4,200	—
Not signed; „	Huddersfield, Honley	650	250	900	20
		39,920	12,243	52,163	1,085

From this table we learn that 17 manufacturers employ in the aggregate oil to the value of 40,000*l.*, and soap, 12,000*l.*, together 52,000*l.*; and that the amount received from the contractors for liberty to recover the grease is about 1,000*l.*, or *two per cent.* This calculation is not strictly correct, because in three of the cases no amount is paid, the grease not being extracted, but it is sufficiently so for all practical purposes.

The sums received by the manufacturers are indeed hardly worth consideration, and in some cases the cost of steam and of plant and working space has to be deducted.

As this trade of grease extraction is not confined to one firm, but is practised by many persons throughout the district, it would appear that the payments in question are the fair market value of the privilege, and that the profits are not of a nature to afford larger royalties to the manufacturer. If this be so, if the grease extractors do not realize excessive profits, what becomes of the large value which is put into the wool in the shape of actual oil and the grease in the soap?

The settlement of this question is of no slight importance: if it can be shown that the process for separation of grease is carried on in a slovenly and wasteful manner, that a large proportion of the grease is lost or injured, and that the refuse liquid which results from it is not nearly so cleansed as to satisfy the requirements of river purification, and if, further, improvements can be suggested which would be attended with greater pecuniary results as well as greater purification, it is obvious that there would be no injustice in calling upon manufacturers to adopt them.

We shall therefore as briefly as possible endeavour to trace the large sums spent in oil and soap, and see what becomes of them. For this purpose we shall select the return of Messrs. David Yewdall and Sons, Calverley Grange, Leeds.

This firm consumes annually 1,500,000 lbs. weight of wool, all of which is washed. In washing this wool they employ 28,000 lbs. of alkali and 12,000 gallons of human urine, besides a much larger quantity of urine in scouring the cloth subsequently; but our business is not now with either of these substances.

* Some of the returns are not fully made, and others are from manufacturers who do not use the ingredients we are here treating of.

In working the wool they use Gallipoli and other olive oils to the extent of 3,500*l.* which sum would represent about 58 tons of such oils.

In carding the wool 64,000 lbs. of waste is produced, which is sold to the waste dealers, who probably extract the oil and sell the residue as manure.

The goods are then washed at a cost of 1,000*l.* in soap, which amount would probably represent 33 tons of soap (at 30*l.* a ton), containing at a low estimate 11 tons (at 33 per cent.) of grease.

If the whole of the oil used and the grease of the soap were to be found in the soapsuds, it would simply rest with the skill of the extractor to recover them, but this is not quite so. In the process of carding a quantity of short wool is produced and separated.

This, which contains a large proportion of oil, is, as before stated, sold to the "waste" dealers. Messrs. Yewdall return 64,000 lbs. on 1,500,000 lbs. of wool, or 4½ per cent., as their annual waste. Three samples were furnished for analysis by Messrs. Yewdall as representing three different qualities of this waste. When examined in the usual way they were found to contain of oil and fatty matter by weight—

No. 1.	No. 2.	No. 3.
30·53 per cent.	39·58 per cent.	43·15 per cent.

Quite recently we received three other samples of wool waste from Messrs. Yewdall who at the same time gave approximately the proportion in which these several kinds of waste were produced in their mill. The following table give these data together with the oil in the whole waste.

No.	lbs.	Oil per cent.	Total oil.
1	14·000	42·15	5,901 lbs.
2	20·000	30·79	6,158 „
3	30·000	33·05	9,915 „
			21,974

The whole quantity of waste (64,000 lbs.) contains 21,974 lbs. of oil, or 34·3 per cent.

Taking 35 per cent. as fairly representing the quantity of oily matter in the whole of the waste produced in Messrs. Yewdall's works, we find that the 64,000 lbs. of waste wool produced in the year would carry away with it 22,400 lbs. of oil or exactly 10 tons.

A further, but comparatively small quantity, of oil is accounted for as being left in the manufactured cloths as sold from the warehouses, and therefore out of the reach of the grease extractors.

The following determinations of oil in pieces of new cloth of different colours obtained from a tailor afford data for calculating the amount for which allowance is to be made under this head.

	Per cent.		Per cent.
Blue	1·27	Scarlet	1·14
Ditto	0·66	Dark Brown	0·60
Black	0·77	Chocolate	0·57
Ditto	4·32	Drab	0·56

or an average of 0·73 per cent.

Messrs. Yewdall of Leeds, also kindly furnished 18 samples of cloth, each one of a different shade of colour.

It was not thought necessary to examine these separately, but an equal weight of each was taken and the mixed sample when analyzed gave 0·76 per cent. as the proportion of oil present.

We may safely therefore consider that cloth on an average contains something like 0·75 per cent., or 7½lbs. of oil to each 1,000 lbs. of cloth.

From statements made to us during our inquiry, it may be assumed that the weight of cloth is about half of that of the original wool used. We require therefore, to add to the quantity of oil removed in the wool waste a further amount equal to 3¾ lbs. for every 1,000 lbs. of wool used. Messrs. Yewdall use 1,500,000 lbs. of wool, and the 750,000 lbs. of cloth which they send to market must carry with it 2½ tons of oil.

If, then, from 69 tons of oil and grease employed by Messrs. Yewdall (58 tons as olive oil and 11 tons in the soap used) we deduct 12½ tons as the quantity removed in the waste and in the manufactured cloth, we still have 56½ tons falling under the control of the grease extractor in the soapsuds. It rests with him to carry on his business in such a way as to recover a reasonable proportion of this grease. If he does so recover a fair proportion of this valuable material, and if the expense of the manufacture be not very great, the profits must be excessive. If, on the other hand,

as we before suggested, the amount paid in royalties for the privilege of extraction is the fair market price of that privilege, and leaves only a sufficient margin for reasonable profit to the contractor, we must infer that his business is carried on in a very unsatisfactory manner, and is open to great improvements. In the particular case quoted we are unable to follow the matter further. We know that the yearly soapsuds of Messrs. Yewdall and Sons must contain nearly 60 tons of oily matter, and we know that the contractor pays to the firm 75*l.* a year for the opportunity of extracting as much of this grease as he thinks desirable. We have clear evidence that the oil extracted is worth 18*l.* or 20*l.* a ton. Supposing, therefore, that 50 out of these 60 tons were extracted, a sum of 900*l.* to 1,000*l.* would be applicable to meet costs of acid, labour, cartage, wear and tear of presses, &c., and profit upon operation. We shall immediately show that the grease extractor does not recover anything like the quantity of grease from the soapsuds which he might do, and that in a subsequent part of the operation he loses a further large proportion of that which he has separated.

Before proceeding to offer further instances of this kind it is necessary that we should state that the proportion of *waste* produced in combing and carding wool differs very greatly in different mills as shewn by the following table.

——	Wool lbs.	Waste.	Percentage.
Akroyd, James & Sons	343,000	15,000	23·8
Armitage Bros.	347,000	62,400	18·0
Bates, John	350,000	50,000	7·0
Barker, R. H. & Co.	1,000,000	35,000	3·5
Brooke, Jas. & Sons	170,000	56,000	33·0
Brooke, John & Sons	535,000	107,744	20·1
Clay, Daniel	1,117,600	132,440	11·9
Crowther, Alfred	500,000	No return	—
Crosland, Geo. & Sons	600,000	80,000	13·3
Howgate, Jas. & Sons	1,080,000	112,000	10·4
Sugden, Jonas Bros.	1,000,000	30,000	3·0
Wormald, John	3,600,000	348,000	9·7
Yewdall, David & Sons	1,500,000	64,000	4·3
Not signed; post-mark Bradford	1,440,000	48,000	3·4
Not signed; „ Halifax	2,400,000	No return	—
Not signed; „ Huddersfield, Shepley	300,160	No return	—
Not signed; „ Huddersfield, Honley	300,000	Burnt	—

It will be seen that the proportion of *waste* varies from 3 per cent. up to 33 per cent. depending no doubt in a great measure upon the quality of the wool and the nature of the fabric made. A knowledge of the proportion of *waste* is of importance to our present purpose, inasmuch as we seek to ascertain the quantity of oil in the soapsuds by the difference between that which is actually used, and that carried off in the *waste*, and the cloth.

In the following table, which extends the illustration given in the case of Messrs. Yewdall to a number of returns, we have calculated the oil in the *waste* at 35 per cent. in all cases, but it is probable that by so doing we have largely *over*-rated the oil removed, and consequently *under*-rated the quantity left in the soapsuds.

——	Oil at 60*l.*	Soap at 30*l.*	Oil in Soap at 33 per cent.	Total Oil.	Oil in Wool Waste at 35 per cent.	Oil in Cloth.	Oil in Waste and Cloth.	Oil in Soap-suds.	Value of Oil in Soapsuds at 18*l.* a Ton.	Royalty paid.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	£ *s.*	£
Akroyd, Jas. & Sons	4¼	3¼	1	5¼	2	½	2½	2¾	49 10	—
Armitage, Bros.	24¼	9	3	27¼	9¾	½	10¼	17	306 0	80
Bates, John	7½	8½	2¾	10¼	7¾	½	8¼	2	36 0	—
Barker, R. H. & Co.	50	24	8	58	5½	1¾	7¼	50¾	913 10	100
Brooke, John & Sons	47½	19¼	6½	54	16½	1	17½	36½	657 0	55
Brooke, Jas. & Sons	12¼	7	2½	14¾	8¾	¼	9	5¾	103 10	30
Clay, Daniel	50¼	16	5¼	55½	20½	2	22½	33	594 0	150
Crosland, Geo. & Sons	38	24	8	46	12½	1	13½	32½	585 0	40
Howgate, Jas. & Sons	58	46½	15½	73½	18½	2	20½	53	954 0	55
Sugden, Jonas Bros.	6½	17	5¾	12¼	4¾	1¾	6	6¼	112 10	80
Wormald, John	140	60	20	160	55	6	61	99	1,782 0	130
Yewdall, David & Sons	58	33	11	69	10	2½	12½	56½	1,017 0	75
Not signed; postmark Bradford	16½	75	25	41½	7	2½	9½	32	576 0	100
Total	513	342	125¼	627¼	178½	21½	200¼	427	7,686 0	895

We learn that of 627 tons of oil and grease (in soap) used in thirteen mills 200 tons leave the works and warehouses in the waste wool and cloth, and 427 tons pass away in the suds. The value of this oil at 18*l.* a ton, deducting Messrs. Akroyd and Mr. Bates, whose suds are not treated, is 7,600*l.*, whilst the price which the contractors find it worth their while to give is 895*l.*, or 12 per cent.

We shall now endeavour to show how the great discrepancy in these figures is to be explained.

We have in a previous part of this Report described the method of treating the soapsuds, &c.

The quantity of acid employed will differ according to the greater or less richness of the soap water, but the following will give a fair idea of it. The Commissioners visited Mr. Lister's works at Halifax, and had an opportunity of seeing the acid added to a tank of soapsuds. The experiment was not made expressly, but came in the ordinary course of treatment.

To 3,600 cubic feet, or 22,500 gallons of soapsuds, three carboys of "brown acid" were added. This quantity of brown acid would weigh about 4 cwt., and would cost 15*s.* or 16*s.*

A sample of the liquid was taken for analysis, and was found to contain 653·4 grains of grease per gallon. According to this the whole quantity of grease in the tank was 2,350 lbs., or somewhat above a ton. To separate a ton of grease from soapsuds would therefore cost less (supposing the whole grease to be recovered) than 1*l.*, so far as the acid was concerned.

The water which is allowed to flow away from the tanks is more or less improved by the treatment to which it is subjected.

In answer to the question "Does the water from the grease process pass away clear or how nearly so?" Mr. Wormald makes no return; Messrs. Crosland say "Very dirty;" Messrs. Brooke say, "Not nearly clear at all;" Messrs. Barker say, "Nearly clear;" Messrs. Yewdall, "Very nearly;" Messrs. Armitage, "Not quite clear;" Messrs. Howgate, "Very clear," and so on.

Our own experience is not in favour of the success of this method of clearing the water. It has not been our fortune to see any instance of this process being carried out with the result of "very clear" effluent water. On the contrary, in the examples which we have seen the appearance of the liquid has not been sensibly affected by the treatment, and the water has escaped foul and objectionable.

When the liquid passes away foul and uncleansed we may take it for granted that grease is being wasted.

The following are analyses of samples of soapsuds and of refuse water from their treatment :—

—	Messrs. Rouse and Co's Mill at Bradford Wool-washing.	Soapsuds from Messrs. James Brooke & Son.	Mr. Lister's, Halifax.	Refuse Water from Grease Works.	
				Messrs. Hamilton's, Bradford.	Messrs. J. Smith & Co., Bradford.
Solid residue grains in a gallon -	758·94	540·40	1,246·0	506·5	314·72
Fatty matter - - -	518·7	266·20	653·4	117·0	67·9
Other organic matters - -	17·5	Not	—	189·1	90·3
Mineral matter - - -	222·7	ascertained.	—	200·34	155·5

The two end columns show that grease, amounting in the one case to 68·9 grains, and in the other to 117 grains per gallon, are wasted in the cases quoted, but the table does not afford the means of calculating the proportion of the whole so lost.

By the kindness of Mr. Seed of Huddersfield we are enabled to supply this deficiency. Mr. Seed sent to the laboratory of the Commission for analysis samples from different mills where he separates grease from soap-waters. In each case a sample was taken from the tank of the soap-liquid when full and ready for addition of acid, and another sample of the liquid as discharged. The following Table shows the general character of these samples, the words "before" and "after" meaning before and after treatment for separation of grease :—

	Mineral. Grains per Gallon.		Organic. Grains per Gallon.		Total. Grains per Gallon.		Grease. Grains per Gallon.		Grease separated.	Percentage of grease separated.	Percentage of grease lost.
	Before.	After.	Before.	After.	Before.	After.	Before.	After.			
Greenwood & Hansons	530·32	304·50	1204·21	282·80	1734·53	587·3	1099·56	193·76	905·8	82·4	17·6
Broadbent - -	103·27	223·30	261·43	284·62	364·70	507·92	220·64	176·96	43·68	19·8	80·2
Schofield - -	122·50	220·85	430·36	318·71	552·86	539·56	365·23	61·60	303·63	83·4	16·6
Mellor - - - -	215·25	243·25	906·85	791·35	1122·10	1034·6	790·20	393·85	396·35	50·2	49·8
Shaw - - -	82·32	185·5	436·24	387·80	518·56	573·3	397·74	271·74	126·00	31·8	68·2

The two last columns show the percentage of grease recovered and lost. In no case is more than 83 per cent. of the grease obtained, which, however, is a fair success; but on the other hand, in one instance, half the grease is lost, in another nearly 70 per cent., and in another 80 per cent.

We have no reason to believe that Mr. Seed is less successful in the treatment of the soapsuds than other contractors, although it is probable that where heat is employed the separation is more effectual, and the inference is plain that the grease process, as practised, does not recover half the oily matter present in the soapsuds, and which might be recovered by a more perfect process.

But the loss of material suffered by the grease contractor does not end with the acidifying process. We have mentioned that the "magma," or thick greasy extract from the soap waters is carted from the mills to the premises of the contractor, where the oil is separated from the dirt. For this purpose coarse cloths are filled in a frame with perhaps 10 or 15 lbs. of the material, and are then placed one above the other with intervening sheets of iron in a screw press. This press is in the form of a cupboard, with a door closing the front. When the press is charged steam is thrown into it; the screw which works by a handle above and outside the case is turned from time to time till the oil ceases to flow. When this period is reached, the press is opened and the cloths containing the residue in the form of cakes are removed.

We have not the data for calculating what weight of this residual cake is produced in relation to a given quantity of oil, but it is certainly very considerable—heaps of the material of a great many tons in weight will be seen lying on the premises of the grease contractor. Samples of this cake have been examined to ascertain how much fatty matter was left after the action of the press.

The following is the result of such examination of three samples from Mr. Seed:—

	Per cent.
No. 1 fatty matter - - - - - -	28·89
No. 2 ,, - - - - -	17·16
No. 3 ,, - - - - -	18·01

Mr. Seed employs sawdust to help to dry up and render portable the greasy matter left in the precipitating tanks after the water has been run off. This sawdust would of course retain a good deal of the oil which would otherwise be separated from the cake by pressure, but under any circumstances this method of extracting could never remove the whole of the oil.

The cake is sold for manure, and is said to be very fertilizing. The following general analysis of a sample of it may not be without interest:

Moisture - - - - -	24·42
Fatty matter - - - - -	17·16
Other organic matter - - - -	42·86
Mineral matter - - - - -	15·56
	100·00

The organic matter contains nitrogen 3·34 equal to ammonia 4·0 per cent. of the cake. It is probable that to this nitrogen is chiefly to be ascribed the fertilizing action of the cake, and that the removal of the oil would not diminish its agricultural value. The mineral matter is principally mud and dirt of no value as manure.

The oil which flows from the presses is thick and nearly black; it is we understand usually sold by the smaller grease contractors to firms like Messrs. Teall Lepaige

and Co., of Wakefield, who distil it and obtain light coloured oils, stearine, &c. in a fit state for the market.

It must not be forgotten that the oil which is used in the manufacture of the cloth is bright nearly colourless olive oil, worth 60*l.* a ton, and that the grease which is recovered is black and turbid and worth less than 20*l.* a ton. Here in itself is a loss equal to two-thirds of all the money which is spent upon oil and soap in the West Riding of Yorkshire. It is probable that discolouration of the oil is to a certain extent due to the colouring matters of the dye stuffs, and is not preventible, but we incline to the opinion that some part of the injury is caused by the sulphuric acid aided by heat in the process of pressing.

Having shown that the grease extraction as at present practised is unsatisfactory in the extreme, we would beg to offer some suggestions for its improvement, founded on scientific and practical knowledge of the subject, which may have the double advantage of effecting important economies and of purifying the soap water before discharge into the rivers. It will be understood that there are in the soapsuds two forms of oil or grease; the oily matter united with alkali to form soap, and the free or uncombined oil which has been put to the wool and is removed in the fulling and washing process. Part of this oil may be combined in the washing process with soap, but the greater part is really present as oil in a high state of subdivision, similar to what doctors call an "emulsion." However this may be it will be evident that the addition of sulphuric acid has for its object the decomposition of the soap which occurs by the union of the acid with the potash or soda of the soap, and the separation of the oily acids from their combination with the alkali. After treatment with the acid we have therefore no longer any soap present; instead of it we have sulphate of soda or potash (according as hard or soft soap has been used) and the fatty matter both of the soap and the oil liberated. The fatty matter of this soap being lighter than water rises to the surface, carrying with it some of the oil which is distributed through the liquid. In the cold liquid this action would be anything but perfect, and we can readily understand how great advantage is gained by the employment of heat introduced and patented by Messrs. Teall & Co.

But the action of acid is not the only method by which this decomposition of the soap and separation of the grease could be effected; for the soda of the soap it is possible to substitute other bases, such as lime or oxide of iron, and the lime or iron soap so produced is insoluble. We believe that lime has been proposed, if not used, as a means of treating the soapsuds, but we have not heard that salts of iron have been thought of. If lime were employed it would be in the state of burnt lime, made into a thin paste with water, known as "milk of lime." We have made repeated trials of lime in the laboratory, and can speak very favourably of its action. When added judiciously and without excess, it causes a ready separation of the soapsuds into clot and clear liquid, and the action is greatly aided by the addition of a small quantity of alum. One of the witnesses at Huddersfield (Mr. Seed) spoke of alum having been used in conjunction with acid, but this would obviously be an improper employment of it, as the clearing action would depend upon the neutralization of its acid by an alkali.

The "magma" separated from the soapsuds by lime would not be greasy; it would be, as we before said, an insoluble soap. The liquid flowing away would be *alkaline* from free *soda*, not acid as it is by the present method; indeed the rivers would be doubly benefited by the discharge of clear instead of foul liquid, and soft water instead of water laden with salts. The insoluble lime compound would require to be decomposed by acid subsequently, but this would be done by the extractor at his works, and under favourable circumstances, and the sulphate of lime produced would not need to pass to the rivers.

The use of salts of iron for cleansing the soapsuds might prove equally beneficial. Perchloride of iron in solution, added to the soap waters, produces a ready separation of the fatty matters and a clear liquor for discharge. Sulphate of iron or "green copperas," which is largely used in the dyeing of black goods, is also available for this purpose. The iron-soap produced would be subsequently decomposed by sulphuric acid and the iron recovered as sulphate of iron for further use.

It might indeed be practicable, where black dyeing is carried on, to employ the dye water as a means of coagulating the soapsuds and separating the oil and grease, or if this should not answer, on account of the solid black matter of the dye interfering with the subsequent extraction of the oil, or injuring it in any way, the liquid of the dye waste filtered without the addition of lime, and therefore containing as we have shown much sulphate of iron in solution, might be employed with advantage.

So far we have mentioned some of the chemical agents by which the soap liquids

may be treated. No doubt others may be found equally efficacious and will commend themselves for employment in particular circumstances. Then as to the system of discharging the liquid after the addition of the acid or other chemical agent; at present the great bulk of the liquid is run off without filtration, and it is only the thick stuff from the bottom of the tanks which is thrown on a coarse filter as before described and that not in all cases. But it is worthy of note that where this method of drainage is practised, the water runs away bright and comparatively unobjectionable. Of this fact we have proof in repeated personal observation as well as in the evidence of witnesses. What then is to prevent the *whole* liquid being made to pass through a filter before discharge into the streams? And might not some mechanical arrangement, such as the press of Mr. Needham, be advantageously used for this purpose? There is still another point to which the grease collector's attention should be directed, namely, the ultimate separation of the crude oil from the mass collected from the tanks. We have before stated that much of the colour and thickness of the expressed oil is due to the action of sulphuric acid in the process. Where the suds are treated cold it is probable that this injury occurs in great part in the press, which is heated by steam. To remedy this the greasy mass should previously be abundantly washed with water just warm enough to melt it; in this way the last portions of acid would be removed. Where steam is used to heat the soap water during the acidifying process, some small part of the mischief may occur at this point, and the employment of muriatic instead of sulphuric acid, would be preferable.

But it is questionable whether this system of expression of the oil is in any form the proper one to be adopted. We have shown that even after he has been at the expense of separating the greasy material, the extractor sacrifices a large but as yet undetermined proportion of his product in the grease-cake which is the residue from the press, and although this cake is sold for manure, at say 2*l.* or 3*l.* per ton, it is clear that no adequate return is thus obtained for the 20 or 30 per cent. of oil which it contains, and which would be worth 18*l.* a ton if recovered.

We would here suggest the possibility of employing bisulphide of carbon to extract the oil from this cake, or, better still, to extract the oil from the whole material without use of the press.

The use of this substance is sufficiently familiar to those persons in Yorkshire and elsewhere who are engaged in the recovery of oil from waste wool, and we do not see why it should be inapplicable to the purpose in hand.

With whatever results its employment in the case of waste wool may have been attended, and of this we are not in a position to speak, we learn that in France it is most successfully used in the very case for which it is now suggested, that is to say, in the recovery of grease from soap used in washing silk.

It is stated that "very large quantities of the sulphuret of carbon, the price of which "has fallen from one guinea per lb., which it was in 1847, to about three halfpence "per lb. for which it can at present be obtained, are used in France for this purpose. "Upwards of 50,000 tons of soap used in the silk manufacture were formerly "allowed to pass off to waste into the Rhone; most of this is now recovered to be "again employed in manufacture." It will of course be understood that it is the grease of this soap, and not the soap itself, which is so recovered.

There surely can be no reason either in the price of the chemical agent used or in other conditions peculiar to the case before us, why a similar process should not be introduced with advantage in the woollen districts of this country.

Before quitting the subject of this grease recovery a few general remarks may not be out of place. It has been shown, though perhaps less forcibly than it might have been by further experiments, that the treatment of the soap waters is far from satisfactory either as a measure of economy or as a means of preventing pollution of the rivers at present suffering from the woollen manufacture. Whatever may be the failing of the line of argument we have adopted, we certainly have not erred in the direction of excess in estimating the amount and value of material which *might be* but at present *is not* recovered from the water with which the goods are washed, and which is now wasted to the great detriment of the neighbouring streams.

The table (page 30) shows that 17 manufacturers dealing in the aggregate with 16,500,000 lbs. of wool use oil to the value of 40,000*l.* and soap 12,000*l.*, together 52,000*l.* a year or at the rate of 3,000*l.* sterling for each million lbs. of wool.

Adopting this figure and applying it in a calculation of the cost of oil and soap used in the whole woollen and worsted manufacture of Great Britain, we have the following startling results. Mr. Behrens gives as the total wool worked, 384,000,000 of lbs., which at 3,000*l.* of oil and soap for each million, gives 1,152,000*l.* as the consumption

of these materials in the wool trade; and taking the West Riding at two-thirds of the entire trade at least 750,000*l.* or 800,000*l.* may be set down as annually spent on these items in that district. Mr. Teall in his evidence speaks of 100,000*l.* worth of grease actually recovered and an equal amount recoverable in Yorkshire, but his estimate is obviously too modest; it is fair to say, however, that this gentleman did not include the small mills, at which, in his opinion, it would not be worth while to adopt any process of recovery; and of the 3,000 odd mills* distributed through the valleys of the Aire and Calder, a great proportion are, no doubt, on a comparatively small scale.

This Commission cannot, however, be expected to view the matter with the eyes or from the point of view of grease contractors. We have no quarrel with these gentlemen, and no intention to say one word in their disparagement collectively or as individuals, but our duty is with the rivers. Small mills which may not be worth the contractor's attention are probably in the agregate guilty of more pollution than the larger ones. It is with the owners and occupiers of mills great and small that the responsibility of discharging foul liquid rests, and the public will naturally look to them and not to their agents for redress.

The entire question of dealing with the soap waste must be met on the part of manufacturers in an earnest and intelligent spirit, and we do not doubt that, with the appliances which science offers, and of which the millowners of Yorkshire have shown themselves well able to take advantage in other respects, so large an economy may be secured that abundant funds will be forthcoming to deal with the other causes of pollution, such as dye and scour water, till such time as these in their turn become, as they surely will, a source of profit instead of a nuisance and a disgrace.

Tanneries.—In our first report we called attention to the necessity of preventing the pollution of the river Thames by the refuse of tanyards, and in the subsequent legislation by Parliament for the better conservancy of the river this question was included; but tanning on the Thames or on other rivers is unimportant as compared to that of which we received evidence at Leeds. Mr. Nickols, proprietor of the Joppa and Bramley tanyards, stated, as the result of information furnished at a meeting of the principal members of the trade, that as many as 2,750,000 hides were annually converted into leather in Leeds and the neighbourhood. The greater bulk of these hides were foreign—chiefly East Indian. These hides are, before shipment for this country, highly salted to prevent putrefaction, and before they can be subjected to the ordinary tanning process this salt must be removed. Hence arises an additional form of pollution requiring special notice.

It is not necessary that we should enter again at any length on this subject. The process of tanning at Leeds (with the exception just mentioned) does not in any respect differ from that usually practised, but the magnitude of the local trade, and the extensive pollution consequent upon it, demand some short notice.

At the Joppa tannery in Leeds Mr. Nickols tans about 12,000 skins of all kinds per week, and he uses 120,000 gallons of water in the same time; but a large portion of this quantity is consumed in the washing of sheepskins, of which 4,000 or 5,000 pass through the works every week. The water from the sheepskins is very foul and dirty; it runs direct into the river.

To remove the salt from East Indian hides, 100 or 120 of them are put into a tank with from 700 to 1,000 gallons of water; after soaking for a day or two, the brine produced is run off, and fresh water is let into the tank several times in succession until the salt is washed out.

A sample of the first soaking was analysed, with the following results:

Total solid residue in an imperial gallon -	692 grains.
Containing organic matter - - -	74 „
„ common salt - - -	549 „

The organic matter contained nitrogen 13·66 grains per gallon.

It is here seen that each gallon of water has dissolved from the hides 550 grains of salt, and 1,000 gallons would at the same rate contain about 80lbs. of salt. Mr. Nickols stated that about 4lbs. of salt is required in salting a hide, in which case a very large portion must remain to be removed by the subsequent washing.

Taking the quantity of salt as determined by this analysis at about 1lb. per hide, which is only one-fourth that which is said to be used in salting, we have an enormous quantity discharged into the river in the course of the year.

* See Appendix No. X. p. lxxxi.

Before discussing the question of disposal of this salt liquid, a few words may be said in regard to the other waste matters of the tanneries. Before the hides or skins, whether English or foreign, can be converted into leather, it is necessary to remove the hair. For this purpose they are soaked in tanks with a mixture of lime and water to swell the skin and loosen the hair, which is subsequently scraped off.

From the evidence before quoted we learn that the water is never run off from these pits; but once or twice in the week water is added to make up for that brought out by the skins, which is considerable. The lime itself, when exhausted, is dug out from time to time and carted away for manure.

Now, although this lime liquor is not absolutely run out into the drains or the river, it is certain that little by little it is brought out with the skins on to the pavement on which the hides are scraped, and thus finds its way to these outlets. And it is not only the liquid which is so removed, but a large quantity of the solid matter which is necessarily stirred up by the removal of the hides.

A sample taken from one of these tanks gave the following results upon analysis:

Total solid residue per gallon	2,016	grains.
Containing organic matter	748	„
„ hydrate of lime	358	„
„ carbonate of lime	119	„

The organic matter contained 147½ grains of nitrogen.

The hair scraped from the hides is sold to the carpet and cheap blanket ("for workhouses") manufacturers, and the very short hair for manure; the fatty matter and skin go to the glue makers.

The hides and skins prepared by the two previous processes are converted into leather by being brought in contact with a variety of substances, which we need not enumerate.

The liquid in these tanks is very valuable, and every care is taken to prevent its being wasted; very little, therefore, finds its way to the river, except upon the rare occasion when the tanks are emptied. The spent bark and solid waste from other tanning materials is usually burned or otherwise disposed of without recourse to the rivers.

The following is an analysis of the liquid running from a spent tanpit at Bramley Hall, near Leeds:

Total solid residue per gallon	1,442	grains.
Organic matter	916	„
Chloride of sodium (common salt)	54	„

The organic matter contained 10½ grains of nitrogen.

Very few words need be said about the disposal of these three forms of refuse. Outside the tanning community itself, from whom we have no right to ask an unfavourable verdict, there can be but one opinion, which is that the refuse matters from a tanyard are disgusting in a high degree, and should on no account be allowed to pass into rivers.

On the other hand, their composition is favourable to the expectation that they would be very beneficial to growing crops.

Mr. Nickols, to whom we are indebted for much valuable information, has (amongst others) shown the practical use of these liquids in agriculture by experiments on his own land. The chief difficulty Mr. Nickols experienced was that he had not land enough for the proper distribution of the whole refuse liquid of his tanyard, and that the liquid from the hide-soaking tank was too strong. It is readily conceivable that a quantity of salt so great as that shown by the analysis would be destructive to vegetation unless the liquid were largely diluted.

In Leeds, and other similar towns, the disposal of the refuse of tanyards will naturally be into the sewers, and so on to land; and when this cannot be accomplished, arrangements must be made for its direct application after sufficient dilution.

Mr. Nickols told the Commissioners that if the tanners of Leeds were deprived of an outlet for their refuse waters, "it would shut up the entire trade, and throw perhaps 20,000 people out of bread."

Such a contingency we cannot, of course, contemplate for an instant; but we believe that the pollution of the river, which is undoubtedly very considerable, from tanning refuse may be prevented without injury to this very important industry.

Ochrey Water.—The water flowing from old coal-workings frequently contains much iron, which is extremely injurious to manufactures when it is brought down in any quantity to the mills.

Evidence was given at Huddersfield of mischief to the extent of thousands of pounds caused by a sudden influx of such water into the Colne and the Holme. This "ochrey" water contains oxide of iron in a soluble state, but the solution rapidly changes by exposure to air, and the iron is deposited as a yellow mud precisely similar to that which is formed from ordinary chalybeate waters and in the little streams flowing from peaty ground (as at the bottom of the embankment of the Redbrook reservoir at Standedge, near Huddersfield). To get rid of this iron nothing more is necessary than to cause the water escaping from the old coal-workings to traverse shallow pools or canals (made tortuous, if necessary, to economize space), so that the current may be arrested and the water freely exposed to the air. In these circumstances rapid and complete separation of the oxide of iron takes place; and this, when dug out from time to time, and allowed to dry, would find a market, and probably more than pay for the small expense incurred in arresting it from passing into the rivers to their injury for manufacturing purposes.

Special Condition of principal Towns visited.

The following remarks are the substance of our observation of the individual condition of the towns we visited and the pollutions caused by them to the rivers on which they stand. Skipton is the town situated highest on the river Aire. The population is about 5,000; the rateable value about 9,000*l*. There is a local Board of Health, and waterworks for the supply of the inhabitants. The district is partially sewered and drained. Out of 1,100 houses some 300 have waterclosets; in all other cases there are privies and cesspits. At some of the factories the excreta of the workpeople is intercepted and is regularly carted away to the land. The town sewage is discharged into a stream, the dry weather volume of subsoil water and sewage being about 200,000 gallons per day; mixed and diluted in Ellar Beck with three or four times this volume of water, the whole falls into the river Aire. Cesspits are emptied from time to time, and the refuse is removed to the land for agricultural uses. Dyeworks, slaughterhouses, tan and lime works, paper mills, and the factories in the district, all discharge the fluid refuse produced into the nearest water-course, sewer, or drain, so that the volume flows into and down the river. There are water-wheels on the "*becks*" and small reservoirs or "*dams*" connected with the cotton factories. The sewage in dry weather is the cause of great nuisance at the water-wheels, and the foul sediment in the dams when flushed out "stinks awful." River improvements have been carried out near Skipton, which are fully described in the evidence, by Mr. Fenwick of Leeds.

Keighley is situate below Skipton and Bingley, on the "*North Beck*," which falls into the river Aire. There is a local Board of Health, and there are public waterworks. The population of Keighley is about 20,000. It has grown rapidly and is increasing, manufactories having recently been extended here. The principal business was worsted spinning and manufacturing; now there is a considerable trade in machine-making, such as spinning machinery for worsted, power looms, washing machines, castings in iron, and tool manufacture. There are 57 mills, large and small, on North Beck, Sladen Beck, Bridgehouse Beck, and the Worth paper mill power has been largely increased of late, and is at this time being further increased. The town has been partially sewered and drained, the fluid refuse flowing into the Worth and Aire. Until recently, solid refuse and furnace ashes from steam boilers were thrown into the natural water-courses flowing through the town, and were consequently swept down the river Aire. The sewage in dry weather is the cause of great nuisance at the water-wheels, and the workmen have frequently been obliged to leave the mills sick.

The amount of solids thrown into the North Beck and the Worth, such as material excavated from foundations, road scrapings, ashes from steam boilers, and other solids, has raised the beds of the streams within 30 years from three to four feet, choking the outlets of drains and sewers, and causing injurious floodings to adjoining lands. Gravel and sand are occasionally washed down by floods, which also tend to raise the bed of the river. Since the establishment of a local Board of Health, throwing ashes and other solids into the streams has been forbidden, but the law is evaded by many and openly defied by some; soapsuds are allowed to flow into the river, which in summer ferment and give off large volumes of foul gases. Local disease is imputed to this form of pollution.

Bingley is situate on the river Aire about four miles below Keighley, the town containing about 6,000 inhabitants; the parish about 10,000. The town is governed under the powers of a private Act of Parliament by Commissioners having a property qualification. There are 30 at present. Elections of commissioners do not take place

by the ratepayers. Harden Beck flows through a portion of the town into the river Aire. Solids are thrown into the beck and into the river by the inhabitants. Refuse from mills and factories, as also sewage, flows in. Most of the sewage goes direct into the river Aire. There are privies and cesspits to most of the houses; waterclosets are exceptional.

Bradford is an ancient town, situated on a "beck," about four miles south of the river Aire, into which the water of this beck falls near Shipley. Bradford Beck flows down through the centre of the town. The area of the watershed at the lower part of the borough boundary is about 11,000 acres, and at its junction with the river Aire at Shipley the drainage area is 14,660 acres. The borough was incorporated 9th June 1847, and in 1841 contained a population of 66,000; in 1851, 103,000; in 1861, 106,000. The township of Bradford in 1801 contained a population of 6,393; in 1811, 7,767; in 1821, 13,064; in 1831, 23,223; in 1841, 34,560; in 1851, 52,493; in 1861, 48,646. During the time the population seemed to retrograde local trade was largely increasing, as is shown by returns made to the Board of Trade. Bradford is the centre of the worsted district, and, according to the returns of exports from that district, the value of the goods was, in the year 1862, about 9,750,000*l.*; in 1863, 13,250,000*l.*; in 1864, 16,250,000*l.*; in 1865, 18,750,000*l.*; and in 1866 they possibly reached 20,000,000*l.*, so rapidly is the trade of the district increasing, owing to the introduction of improved machinery, so that the producing power of the manufacturers has increased more rapidly than the population. The contamination of the streams has increased rather according to the growth of the trade than with the increase of local population. There is increased pollution from dyeworks, from soapsuds, and from refuse of various kinds produced in manufactures. The whole of the sewage of Bradford, and of the populous district above the town flows into the beck, producing an indescribable state of pollution. It has become a Yorkshire proverb of comparison for any foul stream to say of it that it is as polluted as Bradford Beck. At the time of our inquiry Bradford Beck was the source of supply to the Bradford Canal, the fluid in which became so corrupt in summer that large volumes of inflammable gases were given off, and although it has usually been considered an impossible feat to "set the River Thames on fire" it was found practicable to set the Bradford Canal on fire, as this at times formed part of the amusement of boys in the neighbourhood. They struck a match placed on the end of a stick, reached over, and set the canal on fire, the flame rising six feet high and running along the surface of the water for many yards, like a will-o'-the-wisp; canal boats have been so enveloped in flame as to frighten persons on board. Bradford Beck, like other streams in the West Riding on which population has grown up and manufactures have been established, has been choked with solids and polluted with fluid refuse, waste dyewater, soapsuds, and sewage. Throwing in of solids has been prohibited in the town, but on inspection it is evident to sight that any municipal rules to this effect are broken. At some of the large mills mounds of cinders from the steam boilers are placed against walls bounding the beck, evidently to fall or be washed in by rain, and in some instances trap-doors are suspiciously handy for the admission of such ashes into the beck. Although there is a preventive power within the borough, this does not extend beyond, and, consequently, solids, including furnace ashes, are systematically thrown into the tributaries of Bradford Beck.

Leeds is situated on the river Aire. There are tributaries flowing through the town; these are Sheepscar Beck, Holbeck, Benyonbeck, Balmbeck, and Dow Beck. In the year 1080 Leeds was a farming village, having a population of about 300. Bede, in 735, calls Leeds Levdys; in Domesday survey it is Leedes. The population of Leeds at present is about 228,000, the rateable value was 593,779*l.* in 1865, and is rapidly increasing. The parliamentary and municipal areas are coextensive. There are 15 townships within this area, and until the year 1866 each township exercised independent jurisdiction over highways, roads, and drains. The local municipal government has, however, been consolidated.

The principal trades now carried on in Leeds are, in manufactures, woollen, worsted, linen, flax, and silk. There are cloth dressers, large dyers, waste and mungo dealers, and the most extensive tanneries in Great Britain. Many tanneries are situate in a district called Joppa. There are paper mills, oil mills, corn mills, saw mills, chemical works, and glue works, bone mills, iron workers, wire grinders, machine makers, and most extensive iron and steel works. The worsted trade has of late years declined in Leeds.

Up to the year 1841 Leeds was partially supplied with water for domestic uses from the river Aire, being pumped by steam-power from near Leeds Bridge. This

source became so polluted that the works were abandoned, and at present water is taken from the Wharfe; but a great extension of the Leeds water supply is under consideration from the district on the Washbourne, where water of a fine and pure character may be obtained from the millstone grit formation.

Leeds has been partially sewered and drained, the entire volume of sewage, solids and fluids (from 7,000,000 to 12,000,000 gallons per day) being turned into the river Aire above Thorpe Hall pastures, creating a great nuisance.

The whole of the becks flowing through the town are fouled with waste refuse from dyeworks, tanneries, and the various other manufactures, from their source beyond the municipal boundaries to the Aire, which river is also polluted along both margins. Carcasses of dead animals float down until intercepted by shoals and banks, where they remain to become putrid and most offensive. No adequate form of water conservancy is exercised either within or beyond the area of the borough. As the population of Leeds has increased, and manufactures have been extended, the local death rate has risen, until the town is ranked by the Registrar-General amongst the most unhealthy of Great Britain. In the township of Leeds the death rate from 1851 to 1860 was 28 per 1,000, and from 1860 to 1864 was 29·5 per 1,000.

At the skinneries and tanneries portions of the waste materials are utilized. Hair from hides is sold for the manufacture of carpets and cheap blankets; that which will not serve such purpose is sold for manure. The parings and fatty matter cut and scraped from the hides is sold for glue-making. Spent bark is carted away, or is burned in steam-boiler furnaces. An attempt has been made to irrigate grass land with the fluid refuse from tanpits near Leeds, but it appears to have been used in a state too strong, as some of the grass was injured. Sewage from a town or from a manure tank will kill vegetation, as will guano and other manures if applied in too great strength. Manures of any kind must be applied to land under proper conditions if the full benefits they are capable of giving are to be obtained. The site on which Leeds stands is flat on both sides of the river Aire, and also on the margins of some of the tributary becks, but middle and higher portions of the town are on sloping ground, affording good surface gradients. This natural advantage to the free flow of sewage of a quick gradient has been made a disadvantage by constructing sewers and drains having no adequate provision for full and constant ventilation. The houses in the older parts of the town are built in narrow streets and close courts, having common privies, and cesspits crowded in amongst the cottages; in upwards of one thousand instances parts of cottages (bedrooms) are placed over such foul receptacles of putrid matter. It is these mal-arrangements, in conjunction with stream and river pollutions, defective ventilation of sewers and drains, and defective river scavenging, which cause the mortality in Leeds to be so large. There are about 45,000 houses within the borough, and 12,000 privies and cesspits, besides waterclosets, of which there may be 4,000 or 5,000 at present in use. Storing human excreta in cesspits close to houses until the mass becomes putrid is one of the prime causes of preventible disease. Such cesspits are emptied at great cost in money, but they are never cleansed. The bottom and sides are saturated with the taint of rottenness, so that during summer an empty cesspit may cause more injury than when full. Typhus fever is one of the most fatal diseases of operatives, and is also most costly to the community. A labouring man in the prime of life, when killed by typhus fever, generated and intensified by filth allowed to accumulate near his dwelling, beneath his bedroom, in pigsties, in unventilated sewers and drains, or in polluted rivers, leaves his widow and children an abiding burden on the parish. This problem may be worked out stage by stage to the clearest demonstration in hundreds of instances. The privies and ashpits are said to be cleansed betwixt 10 o'clock at night and 7 o'clock in the morning, when the "stench" in the locality under such operation is described as "fearful." About 55,000 tons of such refuse is removed each year, at a gross cost of 7,000*l.*, and an actual loss of about 4,000*l.* The foul state of the becks and river Aire may be inferred by the number of carcasses of pigs, dogs, cats, &c., having been removed to the extent of fifty in a a day; but it must not be inferred that these carcasses are removed with any degree of regularity. Pollutions in Leeds may be placed in the following order as indicating their injurious effects on health:—Polluted subsoil and atmosphere by cesspits and pigsties, polluted water-courses from manufactures, and fouling of becks, river, and atmosphere by defective sewerage and deficient sewer ventilation; these nuisances may be mitigated by improved works and better regulations, so as to reduce the local sickness and materially lessen the annual death rate. The property in Leeds and the trade of Leeds may be fairly called upon to contribute by a small rate to pay for the necessary establishment charges, but they now pay a tax in the form of poor's rates

and charities more than would be required to establish and continue preventive measures. The misery suffered by sickness, and the loss in wages to workmen, if fairly valued, would show that they and their families lose more by neglect of proper sanitary regulations than they would have to pay in money judiciously expended on sanitary rates for proper regulations and efficient works.

Todmorden is situated at the head of the river Calder, which rises at the base of the range of mountains dividing Yorkshire and Lancashire. Millstone grit forms the dividing ridge, and prevails down to the coal formation, which crops out at Halifax and Huddersfield. The mountains range from 1,200 feet up to 1,500 feet elevation, the average rainfall in the district being about 50 inches, in a dry year falling as low as 34 inches; in a wet year reaching up to 67 or 70 inches. The population of Todmorden was in 1801, 2,513, and at the census of 1861, 9,146. The principal trade carried on is cotton manufacture.

A great abuse of the river Calder takes place at Todmorden by general neglect and by throwing in ashes, road scrapings and other solids. The river water is also polluted by sewage, privy refuse, and by fouled water passed in from the several mills. The stream has been partially embanked, but so inefficiently that some portion of such banks usually give way during floods, causing heavy losses to manufacturers and work-people. The mills, machinery, and goods of the manufacturers are injured, and the working people are deprived of employment and wages during the intervals of restoration and repairs. The site on which the town stands is a tolerably level space of land several hundred feet above the sea. The river winds over this ground, and has been raised in its bed, partially by the action of rain-flood waters washing gravel sand and silt from the mountains, and partially by the inhabitants and manufacturers throwing in solids, such as road scrapings, steam-boiler ashes, and the ordinary rubbish common to a town population. There are also mills and weirs which pond the water at certain points; and road bridges have been constructed so low as to impede and back up flood waters, thus adding to the mischief and loss which occurs. At page 398 of the Evidence, a woodcut cross section is given of the river, showing its weak embankments, the relative level of the adjoining turnpike road, of the land, and also of the former bed of the river; the ordinary water line and the flood line to which the water rose on the 16th November 1866 has been added. Our local inquiry was made on the 19th of November, or three days after the flood of the 16th. We inspected the houses in the district, and found that the basements of large mills, containing carding machines and power looms, had been flooded so as to injure much of the partially manufactured goods and utterly to ruin portions of the machinery. Many cottages had been flooded to a depth of several inches, causing great discomfort to the inhabitants.

Some of the manufacturers do not throw their steam-furnace ashes into the river, but have them carted away. Others having always got rid of their ashes (to the extent of several hundred tons per annum) by throwing them into the stream, consider that they have acquired a prescriptive right to do so, which they will defend at law against any objecting manufacturer or riparian owner situated below; but here as elsewhere a prohibition against river abuse by solids and pollution by fluids exercised under Parliamentary river conservancy powers would obtain willing obedience from all parties.

Halifax is a corporate and parliamentary borough, having a population of 56,000 and a rateable value of 165,000*l*. The town is situated on the river Hebble, which is a tributary of the river Calder. The average rainfall is about 36 inches. It is one of the chief seats in the West Riding of the woollen and worsted manufactures. Millstone grit forms the stratification from the western dividing ridge of mountains down to the edge of the coal-field at Halifax. The town is built on ground sloping up from the river Hebble on both sides. Good building stone is obtained from quarries in the locality.

The corporation is proprietor of waterworks, consisting of extensive storage reservoirs, situate above the town: the water is of good quality. There are about 11,500 houses and some 960 waterclosets and 5,000 or 6,000 privies and cesspits. Main sewers have been constructed at a cost of 65,000*l*. The sewers pass the sewage into the Hebble, and so on into the Calder. Much solid refuse is thrown or is washed into the river within the borough, although there is a municipal bye-law against this form of abuse, but beyond and above the borough there is no local control.

The main sewers in Halifax had not been ventilated to such an extent as is necessary, neither had all the houses been drained. From these and from other sanitary defects there was a local death rate in 1861 of 34 per 1,000; by improved

management this has since been reduced to 24 per 1,000. At some large mills the privies are so arranged that the solid falls into receptacles specially provided, and is carted away at intervals to be applied for agricultural uses to land. This practice is not general, but may be made so with advantage.

The several large manufactures, both in Halifax and on the streams above the town, pollute the waters by fluid refuse from washing, scouring, and dyeing. Complaints are made as to special pollutions, but the law is powerless as it exists at present. Special nuisances may be proceeded against by indictment if they can be proved injurious to health, but the onus of such proof must be taken by the prosecutor, and as there is no independent tribunal empowered to provide, enforce, and levy rates to pay for works of prevention, the evil goes on unchecked and accumulating. The streams flowing into and through Halifax are polluted in proportion to the extent of local manufactures, and if no precautionary measures are taken to prevent or to diminish pollution, it will go on increasing with the growth of local trade. The great manufacturers experience the evils of river pollution to which they contribute, and foresee some of the inevitable consequences to which such pollution must ultimately lead, and are willing to aid in carrying out any well-devised remedy. Local association for prevention of abuse and pollution of the streams has been tried and has failed in Halifax.

Huddersfield is one of the principal seats of woollen manufacture. It is situate on the river Colne, which falls into the river Calder. The town stands on the edge of the Yorkshire coalfield, having millstone grit westward, rising up to the ridge of mountains dividing Yorkshire and Lancashire, and ranging from 1,200 to 1,800 feet elevation above the sea. In the year 1801 the inhabitants of the township numbered 7,268; at the census of 1861 the number had increased to 34,877, and this increase is going on. Huddersfield is at present governed by Commissioners. A charter of incorporation is contemplated. The Commissioners have provided waterworks, an extension of which is under discussion; they have also partially sewered and drained the town. Huddersfield is surrounded by manufactories and populations situated on the streams which flow down to and through the town. A list of these mills and of the owners or occupiers, with other details in full, will be found embodied in the Evidence, pages 104 to 109. The whole of the streams in the watershed of the Colne and its tributaries, from the dividing mountain-ridge down by the river Calder, are more or less abused by throwing in solids, as excavations from foundations, ashes from steam-boiler furnaces, road scrapings, &c. In some instances, soaps and oils used in washing and dressing cloth and wool are partially recovered, but not so as to remove all injurious matters from the water. Sewage, dye-waste, and other fouled liquids are poured out to pollute the streams. Mud from the several goits and lodges is flushed from the mills above to those below, and so on to the river Calder.

Dewsbury is an ancient township, situated on the river Calder, and in the midst of the Yorkshire coalfield. The population of the town and suburbs is about 25,000. Dewsbury, Batley, and Heckmondwicke have by joint parliamentary powers established waterworks. The local manufacture is chiefly heavy woollen goods, as witneys, Devons, pilots, kerseys, sealskins, flannels, baizes, serges, blankets, druggets, rugs, coverlets, collar-checks, carpets, cloths, and goods of finer sorts. Dewsbury is also the centre of the shoddy trade. The town has been partially sewered, and some of the houses drained. There are many common privies having cesspits. The town enjoys the accommodation of both water (river and canal) and railway communication. The several mills and dyeworks pollute the river by pouring in their fluid refuse; sewage is also discharged into the river. Urine is used in scouring heavy woollen goods, and is collected from the population around. Dewsbury and the other towns in the district are carrying on a large trade, which has rapidly increased and is increasing, but only so far by more and more abusing and polluting the several tributary streams and the river Calder. There are men living who fished and caught fish in these streams, where, at present, fish life in any form has been rendered impossible. An intercepting drain has been jointly made, parallel with the river Calder, by eight manufacturers, to receive the waste water and dye refuse from each mill, and pass it down beyond the lowest of these eight mills, so that as each mill pumps water from the river intervening, it is equally pure to the entire number. The volume of polluted water is, however, discharged at the lower end of the intercepting drain, so that the river is more polluted at this point than if each mill discharged its refuse water independently. This power of interception would be turned to common advantage if carried

out, as it may be, on a greater scale, and the entire volume of polluted water clarified before discharging itself into any stream or river.

Wakefield is situated on the Yorkshire coalfield, at the north side of the river Calder, which is navigable to the town. It is a municipal and parliamentary borough, having a population of about 23,000 inhabitants. Near the town are the House of Correction, the West Riding Pauper Lunatic Asylum, and the Union Workhouse. There are a new market-place, market-house, and slaughterhouses. There is a weekly market for cattle and sheep, as many as 1,000 head of horned cattle and 13,000 sheep having been penned and sold in one day. The average sale is, however, about 800 beasts and 6,000 sheep. This special trade in live stock materially adds to the pollution of the river below the town. There is a large trade in corn, malt, and wool; worsted spinning is carried on, and there are several dyehouses. Cocoa-fibre mats and matting are made and woven extensively at the prison, as also by private firms. The town is partially sewered and drained, the sewage containing the washings of the cattle and sheep-pens, as also of the slaughterhouses, being delivered into the river Calder below the town. A private waterworks company pumps water from the river below the outlet of the sewage, and filters it for the domestic uses of the inhabitants. A description of the works and the processes of clarifying and filtering this water is embodied in the Evidence. The mayor and others remembered in their youth fishing in the Calder, opposite Wakefield; at present the water comes down containing the sewage and dye-water refuse, soap waste, and other forms of pollution as discharged from Todmorden, Halifax, Huddersfield, Dewsbury, and all the other towns, villages, mills, and dyeworks situate above. In dry weather the banks of the river are covered with dark thick slime, and the entire volume of water is stained with dye-refuse. There are many common privies and cesspits, causing local nuisance and excess of disease. The earth-closet system has been tried at the prison and a letter from the governor on the subject will be found, Appendix No. 2.

Pontefract, commonly called Pomfret, is an ancient borough and market town. It was a borough in the reign of Edward the Confessor, but it was not incorporated until the second of Richard III. The population is at present about 5,300, and the rateable value 15,000*l*. The local government is vested in the corporation and in 33 self-elected street commissioners; these two bodies act independently of each other, from which divided jurisdiction much injury arises in sanitary and other respects. The mortality has increased from 14·8 in 1861 to 29·1 in 1866. The Local Government Act has not been adopted. In such large towns as Birmingham, Sheffield, Leeds, and in other places, street commissioners have been superseded by the corporations, which in all cases are representative. Pomfret moves more slowly in consolidating her means of local self-government. The town has been partially sewered, the sewage flowing into the canal. There are 1,202 houses and 175 waterclosets. There are waterworks in the hands of the commissioners; water is pumped by steam-power. Pontefract is situate on the permian or magnesian limestone formation, at the eastern margin of the Yorkshire coalfield, and at some distance from the river Calder. The town of Castleford is situated near the junction of the rivers Aire and Calder. In neither town is there much of the woollen or worsted trades carried on. Inquiry was made at Pontefract because it is situate in the lowest drainage area of the combined watersheds, and though serious pollutions are not added either by Pontefract or by Castleford, the river Aire bears along the combined pollutions of the entire drainage areas of both itself and the Calder, and consequently the whole of the pollution of the woollen and worsted manufacturing district of the West Riding.

The injury inflicted by the river pollutions of these and other towns to the estates of many riparian owners is very great; streams which in the memory of men now living were comparatively pure and well stocked with fish, are now black and stinking. The land through which such polluted streams flow is ruined for residential purposes, and is injured and reduced in value even for mill purposes; the water is so bad as to be considered unfit for manufacturing uses, and other sites are selected where water can be obtained from canals, or by sinking wells and boring. In many instances cattle will not drink the local river water, and farms are depreciated in consequence. Large country-houses which formerly, with their river frontage, rights of fishing, and ornamental gardens and pleasure grounds, were valued as residences, have been abandoned, or are let merely at farming rents and for farm purposes. The cattle plague prevailed to a great extent in the Thorp Hall meadows below Leeds, and on lands bordering foul rivers in other districts. This fatal disease was considered by the tenants and riparian proprietors to have been aggravated by the foul state of the water,

and by the tainted atmosphere caused by river pollutions. The towns are poisoned in some degree by their own sewage and cesspool matter, and are taxed to a considerable extent to remove this putrid refuse in a most barbarous manner. Manufacturers pollute the water for each other until the streams have to be abandoned for all but the coarsest purposes of trade, and clean water has to be purchased from waterworks companies, or must be sought at great cost in well-sinking and boring, to which must be added the charges for extra steam-power. In some cases the manufacture and dyeing of finer sorts of goods has been necessarily abandoned, and in other cases extension of manufacture is rendered impossible because there is no additional volume of clean water to be obtained in the district.

Water Supply.

We have already shown in previous sections of this Report how great a change has occurred in the condition of the rivers of the West Riding of Yorkshire during the last century and indeed within the last 25 or 30 years. Several witnesses examined at Wakefield and at Leeds spoke to the original purity of the rivers Calder and Aire, which at those points carry the combined waters of many subsidiary valleys and of large areas of country.

Mr. Rhodes, the Mayor of Wakefield, says, "In my early days the river here was "pure or nearly so. I am speaking of the river Calder: the water was sweet and clean, "and it was full of fish;" and Mr. Oxley, the Mayor of Leeds, in reply to the question, "Have inconveniences been suffered within the borough of Leeds from the pollution "of the river, and the water being rendered unfit for drinking purposes?" said, "So much so, that I know formerly the water that was supplied to Leeds for domestic "purposes was taken from the Aire; but it became so offensive that of necessity a "different supply was sought for." And this evidence was abundantly confirmed by many other witnesses. Of the condition of the river Calder at Wakefield, and the most important streams of the district at the present time, the Commissioners scarcely required evidence other than that afforded by their own observation; but such evidence abounds for those who will take the trouble to read the shorthand writer's notes of each day's inquiry in Vol. 2 of this report.

With this changed condition of the rivers, with foul instead of clean water flowing in the smaller streams, past hamlets and villages, and water still fouler because more repeatedly used and abused flowing in the rivers and through the large towns, we are prepared to find greatly diminished facilities for the domestic supply of the district, and ought to find corresponding arrangements for obtaining that supply from other sources.

Before the great extension of the woollen and worsted trades, the inhabitants of the West Riding obtained their supply of water for domestic uses from springs or from streams the product of springs, and in a great number of instances they do so now, both in villages and in small towns in the higher parts of the valleys.

The supply of water from springs is however for the most part limited in volume, and in some cases must either be carried home by hand or be purchased from itinerant water-carts at a cost which tends to reduce to a minimum the quantity consumed, and is provocative of uncleanliness and its attendant evils, whilst the streams have in great part ceased to be fit for drinking purposes or even for cleansing or culinary use.

As water becomes more and more monopolised for trade purposes, the sources now used for domestic supply will be still more irretrievably cut off, and unless remedial measures be adopted many of the working classes must be more and more driven to a use of discoloured and tainted water.

In dry seasons many of the inhabitants of the West Riding now suffer a water famine, and that even where there is an abundance of good and wholesome water available if it were properly collected, stored, and distributed.*

The question of the water-supply of the district of the Aire and Calder is so intimately associated with the well-being of the inhabitants, not only as a community requiring this necessary element for general and domestic use, but as a great centre of manufacturing industry to which good water is indispensable, that we require no apology for entering upon the subject in some detail, in order to show what has been, and what remains to be, done towards supplying a want which is now so widely experienced.

It has been seen that the united watershed of the Aire and Calder valleys down to Castleford comprises an area of 708½ square miles, of which the greater portion or about

* For some observations and suggestions in relation to the formation of Impounding or Storeage Reservoirs, see Paper Appendix No. VII,, p. lviii.

600 square miles is covered by millstone grit and the coal measures in about equal proportion; nearly 100 by limestone, and the remainder by the Permian formation, new red sandstone and alluvium.

From the composition of these geological formations the waters of the different parts of the districts take as a matter of course their distinctive characters as to softness and purity. Analyses of some of them are given further on.

The *quantity* of water available for the supply of the West Riding is, as in other cases, materially influenced by the physical, as its *quality* is by the chemical characteristics and conformation of the districts.

The *Basin of the Aire* extends 45 miles above the junction of the Aire and Calder, and is about 8 miles in width. The ridge of the watershed varies in height from 500 feet (opposite Leeds) to 1,500 feet above Ordnance datum. The Aire issues from Malham Cove, a river apparently of much larger volume than the immediate gathering ground would yield. In many places beyond Malham the surface water escapes into swallow-holes, and this water finds its way by subterranean channels to the outlet at Malham Cove.

The *River Aire* flows throughout its course nearly parallel to the ridges of the watershed, at a distance of about three miles from the northern and five miles from the southern boundary in the upper part, and nearly midway between them below the junction of the Bradford Beck. The river falls rapidly from Malham to Gargrave, where it is 360 feet above Ordnance datum; thence it descends more gradually, but with uneven fall to Castleford, where it is 40 feet above Ordnance datum. The Aire for the most part flows at the bottom of a deep valley with hills rising steeply on each side of it.

The *Basin of the Calder* is about 35 miles long, and varies considerably in width; the ridge of the watershed is from 500 to 1,600 feet above Ordnance datum.

The *River Calder* flows nearly parallel to and about five miles from the northern boundary of the watershed. The Colne, which is its principal tributary, rises 13 miles towards the south. As in the Aire Basin the water passes rapidly to the river.

The river resulting from the junction of the two streams, and which below such junction is known as the "Aire" has a gentle fall for nearly 30 miles, till it joins the Ouse a few miles above Goole, collecting the rainfall from a limited area of about four miles in width.

The *rainfall* varies considerably in different localities over this area, for instance—

Mr. Fenwick gives the average rainfall at Holbeck, Leeds, as 21·91 inches (17·04 to 32·18).

The rainfall at Bradford is 36·00 inches.

„ Huddersfield, 32·00 inches (24·39 to 43·83).

The average of 37 years at Halifax, 32·06 inches, varying from 24 to 41 inches.

On the ridge of the basin it reaches 50·00.

The annual average throughout this district is probably about 36 inches, and in droughty seasons about 24 inches per annum.

As regards the *extreme upper part* of the Aire basin which rests on limestone, the water both in the river itself and its tributaries is hard, but not inordinately so; and the question of water-supply, so far as quality is concerned, is not of pressing importance. The rainfall is abundant, the population sparse, and the river very little polluted.

The millstone grit supplies a large volume of the purest water, but many towns, as Bradford and Halifax, have quite outgrown the water resources of the vallies on which they are situated; with coal abundant on the one hand, and pure water from the millstone grit plentiful on the other, they were originally most advantageously placed to meet a rapid increase of trade. Coal is still abundant and cheap, but water, except from a distance, has failed them.

Large quantities of water are drawn from deep wells and bore-holes, but the incessant drain upon the substrata sensibly diminishes this source of supply as shown in the evidence, especially at Leeds and Bradford. The supply of water for trade as well as for domestic purposes has thus become rapidly dependent on distant sources.

Some of the large towns bordering on the millstone grit have at great expense obtained supplies of excellent water from gathering grounds on that formation within the Aire and Calder basins. Leeds and Bradford take water not only from these, but from the Wharfe valley as well.

The water supply of *Leeds* 30 years ago belonged to a private company, and was obtained from the Aire; it is now in the hands of the corporation, and is derived chiefly by pumping from the river Wharfe. The entire volume obtained appears to be about 4,500,000 gallons per diem, of which 500,000 gallons is taken by manufacturers, the

remainder being applicable for domestic and public purposes. The domestic supply is constant, but, as a whole, is becoming insufficient from the growth of trade. Many springs hitherto used for trade purposes are now failing from the increasing drain put upon them by wells and collieries; from one colliery alone belonging to the Low-moor Iron Company at Beeston 2,500,000 gallons being pumped daily. Fresh demands are in consequence made by manufacturers upon the corporation waterworks.

The quality of the present supply is also a ground of complaint. The water of the Wharfe, liable to occasional discolouration from peat, is now becoming deteriorated by the discharge of sewage and manufacturing refuse from towns and places on the banks above the pumping station. In consequence of this, and in anticipation of the increasing wants of a town growing both in population and manufactures, the corporation are now applying to Parliament for powers to resort to a new source, and to bring in a daily volume of 20,000,000 gallons of water.

The corporation of *Bradford* now supplies 1,500,000 gallons per day (or about 12 gallons per head), for domestic, 500,000 gallons a day for public, and 2,500,000 gallons per day for trade purposes, in all 4,500,000 gallons per day, and expects to bring into the town and neighbourhood 10,000,000 gallons per day when the works are completed.

The corporation of *Halifax* supplies now 1,250,000 gallons per day, or 12 gallons per head for domestic purposes, and 292,000 gallons for trade purposes, and will, when works now in progress are finished have a supply of 3,700,000 gallons per day.

Huddersfield has an insufficient and therefore unsatisfactory supply of water for domestic purposes, varying from seven to 10 gallons per head. In 1864 one reservoir was dry and the supply partially ceased. The waterworks are managed by commissioners. More happily situated than others, some of the manufacturers of Huddersfield have an abundant supply for their purposes drawn from the narrow canal, and from springs, and wells on their own premises, or from reservoirs in which they impound the water of the Colne and Holme when it comes down pure; the supply for domestic purposes is, however, acknowledged to be deficient, and the commissioners have applied to Parliament for powers to improve it, but hitherto without success. At present the poorer inhabitants of Huddersfield are occasionally very badly off for water. Mr. Abbey, the surveyor to the commissioners, remarks: "The millowners have fouled the stream, "which was the natural supply of the district. The water was used originally by many "people for culinary purposes, and while the millowners have taken away this natural "supply from these streams, they have not of themselves provided an artificial supply "for those poor inhabitants." As the necessities of *trade* require it there is a call for an improved water supply, and means will be found for accomplishing it.

The trade of Yorkshire is the very life of its inhabitants, poor as well as rich, and any measure would be a fatal blunder which should improve the state of the rivers and the water supply generally to the serious injury of that trade; but we contend that not only is a purification of the rivers and an improved water supply compatible with the best interests of the manufacturers of Yorkshire, but that if the woollen and worsted traders are to continue to progress as they have done up to this time, if even they are to hold their own and continue to prosper at their present developments, such improved water supply must be found and that without delay. We do not believe that any opposing class interests need exist or do exist in the matter, it concerns all alike.

As regards Huddersfield there are no physical difficulties in the way of obtaining an abundant supply of most excellent water.

Dewsbury, Battley, and Heckmondwicke have a combined system of water supply, and there was no scarcity of water during the droughty season of 1864.

The water brought to these towns is used not merely for domestic purposes, but largely and increasingly by the manufacturers. The importance of this for trade is insisted upon by many witnesses; soft water is in fact of great value, and has become an important source of revenue to some of the corporate bodies.

The population of the *lower part* of the Aire and Calder on the coal measures, magnesian limestone, and new red sandstone is very badly supplied with water. The demand for water is enormous, both for domestic and trade purposes. A population amounting to nearly 750,000 is congregated in a small area in dense masses, and vast works are carried on; both population and trade are rapidly increasing. There are not facilities for meeting this demand in a fit and adequate manner; not only are the rivers more impure, as they have received the pollution of the upper districts, but the same circumstances which cause the demand to be great have tended to spoil the supply, and the growth of population and of manufactures has caused a corresponding increase of discharge of sewage and manufacturing refuse into the running waters.

Thus the natural and obvious water supply—that from the rivers and streams in a great measure derived from the millstone grit—is ruined. The water of the subsoil is both inferior in quality and insufficient in quantity. The millstone grit formation, which abounds in water, is at a distance; the large towns of the lower district are consequently reduced to straits. Leeds has to seek for a reinforcement from sources beyond the basin of the Aire in the valley of the Wharfe. Wakefield has as yet provided no better supply for its inhabitants than the polluted Calder. Castleford and Knottingley have to choose between drawing from the foul river or from wells which are capable of yielding only an insufficient and precarious quantity of hard water.

Manufacturers frequently sink bore-holes in their own premises, but this source is apt to fail, so incessant is the drain upon the subsoil water; the richest dig the deepest, and drain the wells of their poorer neighbours, and in their turn are liable to have their own wells drained by pumpings from the collieries.

The water supply to *Wakefield* is a striking instance of the consequences of the uncontrolled pollution of the river. The Calder in its course to Wakefield has drained an area containing 400,000 inhabitants, chiefly engaged in manufacture, and has received directly as well as from its tributaries pollution by sewage, chemical and dye-waste, and many sorts of manufacturing refuse. To this pollution Wakefield, a manufacturing town of 20,000 inhabitants, adds the contents of its own sewers, and the discharge from its own manufactories, and having done so, draws from the stream three-fourths of its water supply. Such a source for human consumption is of course highly objectionable, and at a former period when the water was supplied without preparation or at the most only after sand-filtration it was no doubt unwholesome, as seems to be proved by some cases that were mentioned to us. But the company who own the waterworks, spare no pains by artificial means to improve the quality of the water. The time chosen for pumping from the river is after a fresh, when the volume of water, as compared with the pollution in the river, is the greatest. It is pumped into settling reservoirs of ample size, in drawing from which means are adopted that only the purest part of the water is taken, and this is then filtered by Mr. Spencer's process through carbide of iron. A water is produced bright in appearance, and not injurious to health; in short, as was described to us, "a very fair drinking water." But however free from impurity the water may thus become, the fact that it has been obtained from so impure a source remains, and accounts for if it does not justify the repugnance to it which is felt by many inhabitants of Wakefield.

Castleford has no regular water-supply; the inhabitants about 6,000 in number have to provide water for themselves. For this purpose they resort mainly to wells, but partially still to the river. The river is very foul, and the wells appear to be not sufficiently guarded against impurity, and are liable to be drained by the pumping of collieries in the neighbourhood. In consequence the inhabitants of Castleford suffer in health as well as comfort.

The inhabitants of *Knottingly* are in as bad a plight. They have abandoned drawing water from the river; their supply is now from wells and from the Goole canal, which three miles above receives the overflow from the Pontefract sewage tanks.

To many outlying villages the pollution of the river is an evil as yet without redress. Their natural supply has been taken from them and they are beyond the reach of town waterworks; it is only right that towns, as being the chief causes of river pollution, should extend as far as possible to neighbouring villages the advantages of their artificial water-supply, affording a district rather than merely a town supply. This has already been done in the case of some towns, as, for instance Halifax and Bradford.

But the present condition of the Aire and Calder does not injuriously affect the water-supply for domestic use only; loud complaints are made by manufacturers and landowners. Many who are obliged to use the river water for dyeing and other purposes complain very much of its pollution. In some cases cattle will not drink the river water, and occupiers of land suffer from this cause.

An abundant supply of water of good quality becomes indeed yearly of more vital importance in this district. New towns are springing up, villages expand into towns, whilst some of the large towns have increased twofold within the last 30 years, and an extensive area is rapidly being covered with manufactories of various kinds and residences for those employed in them, so that if the past rate of increase continues the lower part of these valleys will ere long become one connected and continuous hive of manufacturing industry.

We have elsewhere in this report shown that there is no excuse for the discharge

of any sewage or ochrey matter into the running streams and rivers, and that the pollution from soapsuds, dyeing, and other processes, may be prevented, or at all events greatly alleviated.

If stringent measures are adopted to this end the Aire and Calder will be immensely improved as a source of water supply for Wakefield, Castleford, Knottingley, and other towns and villages situated on these rivers.

This leads us to make some observations on the chemical composition of the water.

The waters of the Aire and Calder above the seats of manufacture are derived, as before remarked, almost exclusively from limestone and millstone grit. The following analyses of samples, mostly collected by ourselves during our inquiry, and all of them analysed in the laboratory of the Commission, show the relative purity of these waters before they were polluted.

From the Limestone.	Solid Residue. Grains per Gallon.			Hardness (Degrees of Clarke).		
	Mineral.	Organic.	Total.	Permanent.	Temporary.	Total.
Spring feeding Malham Tarn -	12·13	1·44	13·57	5·00	4·83	9·83
Aire at Malham, when low -	12·00	0·92	12·92	5·49	4·12	9·61
„ „ when flooded	10·53	1·09	11·62	5·88	2·87	8·75
Spring below village of Malham -	9·96	0·34	10·30	3·64	4·41	8·05
Average of four samples -	11·15	0·95	12·10	5·00	4·06	9·06
From the Millstone Grit.						
Bradford.—Stubden reservoir -	4·93	0·77	5·70	3·25	—	3·25
Second sample ditto - -	3·86	1·18	5·04	8·59	—	2·59
Manywells springs at Hewenden	5·40	0·12	5·52	2·24	—	2·24
Second sample ditto from service reservoir.	6·80	0·89	7·70	3·57	0·07	3·64
Halifax.—Ogden reservoir -	4·16	0·55	4·71	2·80	2·75	5·55
Huddersfield.—Holmfirth reservoir	3·33	0·76	4·09	1·86	—	1·86
Brook at Digley below Holmfirth reservoir.	3·81	0·60	4·41	1·89	0·18	2·07
Wessenden reservoir - -	2·82	0·68	3·50	1·69	0·83	2·52
Standedge reservoir - -	3·68	0·20	3·88	2·25	—	2·25
Average of 9 samples -	4·31	0·64	4·95	2·46	0·42	2·88

From this table it will be seen that whilst the water of the millstone grit contains about five grains of solid matter in the gallon, that derived from the limestone furnishes upon analysis 12 grains of such residue. The water of the limestone contains on the average half as much more organic matter as that of the millstone grit. Such a result would appear at first sight to militate against general experience; limestone waters in their natural state of purity are usually free from peaty and other organic matter, whilst water from rocks not containing carbonate of lime—such as the millstone grit—are liable to be coloured by peat.

The explanation in the present case is perhaps that whereas the Malham samples were taken from the open stream, almost immediately after the collection of the water upon the surface, the other specimens are from artificial reservoirs, where large volumes of the water remain in comparative rest, and have an opportunity by deposition, and the chemical action of air and light of becoming free from organic taint.*

The hardness of the water from the limestone is fully three times as great as that from the millstone grit. Omitting the sample from Ogden reservoir, which probably receives part of its hardness from limestone within the area of the gathering grounds, we have a total hardness of about $2\frac{1}{2}$ degrees as the average of the eight samples from the neighbourhood of Bradford and Huddersfield. And with the same rectification nearly the whole of this hardness is seen to be "permanent," that is to say that the water is not reduced by the process of boiling as is the case with the waters from the limestone.

It is to be noticed that these latter, though derived from a limestone district, are not nearly so hard as those derived from *chalk*. From true chalk springs, as in the valley of the Thames, the water issues of a hardness of 17 or 18 degrees, and although

* It may be as well to state here that in these as in all cases the water is carefully filtered in the laboratory before analysis, and the figures given represent only the matter *in solution*.

in the streams themselves this amount is considerably reduced by the influx of surface water from clay and non-calcareous soils, still even when delivered to the London public the water has a hardness of about 15 degrees.

The following analyses of water of three of the London companies made in the Commission laboratory may serve for useful comparison with West Riding supplies.

	Solid Residue. Grains per Gallon.			Hardness (Degrees of Clarke).		
	Mineral.	Organic.	Total.	Permanent.	Temporary.	Total.
New River, Nov. 5th, 1866 -	20·86	0·68	21·54	4·85	9·88	14·73
Grand Junction, Nov. 5th, 1866 -	20·79	0·99	21·78	5·98	8·75	14·73
Ditto, Dec. 3rd, 1866 - -	21·83	0·35	22·18	4·12	10·81	14·93
East London, Nov. 2nd, 1866 -	21·66	0·76	22·42	4·43	9·88	14·31
Ditto, Dec. 3rd, 1866 - -	23·35	0·76	24·11	5·46	9·98	15·44

Compared with the water supply of London the natural waters of Yorkshire even from the limestone have the advantage both in total solid contents and in hardness, whilst those of the millstone grit excel in a much higher degree. In speaking of "hardness" in water a Yorkshireman has indeed in his mind a different standard to that with which a resident in the south of England is familiar—a fact which should not be lost sight of in reading the evidence. Persons accustomed to the hard wells of many districts of England look upon London water as "soft" water, whilst witnesses at Leeds spoke of the present supply of that town derived from the Wharfe, and which is not more than nine degrees, as *too hard* for the purposes of the town.

The following are analyses of other samples collected during our inquiry.

	Mineral Residue. Grains per Gallon.			Hardness (Degrees of Clarke).		
	Mineral.	Organic.	Total.	Permanent.	Temporary.	Total.
Bradford. Tay beck, valley of the Wharfe	4·00	0·76	4·76	2·94	0·98	3·92
Bradford. Barden beck, valley of the Wharfe.	3·09	1·03	4·13	1·89	0·07	1·96
Bradford. Howgill, valley of the Wharfe, limestone districts.	7·85	1·32	9·17	4·62	0·21	4·83
Bradford. Holden beck, valley of the Aire.	9·04	0·54	9·58	5·04	—	5·04
Bradford. Heaton service reservoir, Bradford.	8·09	0·82	9·72	4·90	1·54	6·44
From "Bradley Spout," John William Street, Huddersfield.	26·38	0·62	26·69	11·89	—	11·89
Company's main at George Hotel, Huddersfield.	6·62	0·31	6·93	3·85	0 98	4·83
From spring at brewery of Messrs. Bentley and Shaw, Huddersfield.	9·56	0·45	10·01	5·95	—	5·95

From the first four analyses, and those which are given in preceding tables, it would appear that as to *quality* of water Bradford has nothing to complain of. The same is true of Huddersfield. Of the *quantity* supplied to these two towns we have elsewhere spoken. The water from "Bradley spout" is beautifully bright and pleasant to drink, and we were informed that it is much esteemed for that purpose; it is, however, exceptionally hard, and contains a high proportion of solid residue per gallon.

With examples of the natural and unfiltered water of the districts before him, let the reader now contrast its condition after receiving the impurities so liberally added to the rivers in their course past the different mills on their banks.

The Colne, which takes its rise in the hills above Huddersfield, is joined by another stream, the Holme, at Lockwood, and flows past Huddersfield on its way to the Calder.

The water of Redbrook reservoir at Standedge and of the Wessenden reservoir on the Colne, and of Holmfirth reservoir on the Holme, may fairly be taken as representing the natural and unpolluted water of this district, and we accordingly have associated the average analysis of these three reservoirs with that of the Colne at Lockwood above, and at Bradley below Huddersfield.

	Solid Residue—Grains per Gallon.			Hardness (Degrees of Clarke).		
	Mineral.	Organic.	Total.	Permanent.	Temporary.	Total.
Reservoirs at Holmfirth - - Wessenden - - Standedge - - Average of the three.	3·28	0·54	3·82	1·93	0·28	2·25
Colne at Lockwood, above Huddersfield	8·11	0·69	9·80	4·20	0·40	4·60
Colne at Bradley below Huddersfield	10·53	1·47	12·00	4·75	0·10	4·85

On the Colne and the Holme above Lockwood there are many mills, and their effect upon the water, assisted by sewage and other causes, is to increase the quantity of salts &c. in solution from $3\frac{3}{4}$ grains in the gallon to nearly 10, and this is further increased to 12 grains after passing through Huddersfield. The hardness of the water which at its sources is $2\frac{1}{4}$ degrees, becomes at Lockwood $4\frac{1}{2}$, and below Huddersfield nearly 5 degrees.

The Colne, at Huddersfield, is a considerable stream, and it may readily be understood how large must be the discharge of refuse from the mills on its banks to increase threefold the quantity of salts in every gallon of water passing down it. An easy calculation shows that the increase per gallon being somewhat more than seven grains, a thousand gallons will have received one pound, and a million gallons close upon half a ton of soluble salts, the greater part of which have undoubtedly originated in the woollen manufacture and dyeing processes.

In this estimate no account is taken of the quantity of solid suspended matter discharged from these mills, a subject to which a few words will be devoted further on.

The Calder, at Wakefield, is more polluted than the Colne, as shown in the following analyses:—

	Solid Residue—Grains per Gallon.			Hardness (Degrees of Clarke).		
	Mineral.	Organic.	Total.	Permanent.	Temporary.	Total.
River Calder, above Wakefield - -	19·11	1·02	20·13	5·56	3·23	8·79
River Calder, below Wakefield - -	19·85	1·16	21·01	7·41	1·79	9·20

These analyses do not show any very great effect produced upon the river Calder by the impurities reaching it from the town of Wakefield itself, but it must be remembered that the volume of water is at this point very considerable, and it would require a large addition of pollution in the aggregate to make itself felt in the analysis. Nevertheless there is an increase in the solid matter, both mineral and organic, and in the hardness; some part of this matter, moreover, being changed from "temporary" to "permanent," or in other words, from carbonate of lime to sulphate of lime, by the action of the acids and salts discharged from mills.

But the analysis sufficiently shows the agencies that have been at work. The waters of the limestone districts contain not more than twelve grains of solid matter per gallon. Those of the millstone grit do not exceed three or four. Without attempting to determine in what degree each of these varieties of rock may contribute to the Calder by the time it arrives at Wakefield, we may safely assume that at least one half of the salts in the Calder at this point are due to extraneous sources.

The first two of the following analyses show the quality of the river Aire above and

below Leeds, and the third exhibits the effect produced upon its composition by the discharge of the sewage of the town :—

	Solid Residue—Grains per Gallon.			Hardness (Degrees of Clarke).		
	Mineral.	Organic.	Total.	Permanent.	Temporary.	Total.
River Aire, at Armley Foot-bridge, above Leeds	12·56	2·08	14·66	6·14	2·69	8·83
River Aire, below Leeds, but above sewage outfall.	16·80	1·13	17·93	6·48	2·81	9·29
River Aire, below Leeds and below Sewage Outfall.	20·22	1·44	21·66	7·08	3·86	10·94

There is an inconsistency in the proportion of organic matter in the sample from Armley Bridge, for which we are unable to account. It was taken by one of ourselves, with every care to obtain an average sample, but some exceptional cause must have intervened to raise the organic matter to such a proportion. With this exception, there is no question of the accuracy of the result. And we see that to the total solid residue of 14½ grains per gallon above the town, an addition of 3½ grains is made by direct discharge into the river during its passage through it, and of a further like amount by the main sewer below.

The river Aire, below Leeds, and the river Calder, below Wakefield, come thus to have a chemical composition very closely alike.

By the preceding analyses it has been sufficiently shown that the use of the water of the rivers of the West Riding for woolwashing, dyeing, and scouring, and its discharge into the rivers after these processes, has largely increased the proportion of the *mineral matters* of the water; but it must have occurred to an attentive reader that the *organic matter* of those waters has not increased in anything like a commensurate ratio. It is indeed true that whereas the average of three samples of water before given as representing the water of the Colne in a state of purity, namely, from the Wessenden, Standedge, and Holmfirth reservoirs, contains only 0·54 grains of organic matter, the water of the Calder below Wakefield has similar matter to the extent of 1·16 grains, and that of the Aire below Leeds contains 1·13 grains of such matter. This is not an extraordinary proportion to be found in a comparatively pure water, much less in one which is held to be highly polluted. Two of the samples from Malham, and the sample from Stubden reservoir, Howgill and Barden beck are shown to contain more than one grain per gallon of organic matter, and yet there is no question of their purity and freedom from manufacturing refuse.

Again, although it is highly desirable that water for drinking purposes should be as free as possible from organic impurity as well as from mineral salts, (and the water from the reservoir of Redbrook at Standedge near Huddersfield and that of the Manywells springs at Hewenden near Bradford are excellent representatives of such water,) yet it is no uncommon occurrence to meet with a perfectly wholesome water which shall contain considerably more than one grain of organic matter to the gallon. It would seem, therefore, that, so far as *soluble organic* impurities are concerned, the rivers of the West Riding are not really polluted to a great extent, and of this fact there cannot be a doubt, if we are to believe the evidence of chemical analysis. Are we then to believe either that no great quantity of soluble organic matter is thrown into these streams, or that having been so discharged it is removed from solution by some chemical agency? The explanation probably lies in both of these hypotheses. The quantity of soluble organic matter discharged is *not* very great as compared with the bulk of the water. Few of the towns are systematically sewered, and if we omit Leeds, Bradford, and one or two other places, only a small portion of the solid and liquid excrement of the population at present finds its way to the rivers.

Neither do the processes connected with the woollen and worsted trade discharge large quantities of soluble organic matter into the streams. With the first washing of the wool which, on account of the urine employed and other animal matter, gives rise to a sufficiently disgusting liquid, the discharge of organic impurity is practically

at an end. A certain amount of vegetable matter, as gum, mucilage, &c., is no doubt dissolved from the dye-woods, and passes away in solution in the waste water from the vats, but this vegetable matter is small in quantity and not of a nature to be seriously injurious to the water. The soap-liquids in their untreated condition, or even after the imperfect purification to which they have been subjected by the grease extractors, are, as has been before shown, very objectionable when discharged into running waters, but very little of their organic contents is in a soluble condition and that little in contact with the salts of the water soon becomes insoluble.

The refuse matters of the woollen and worsted manufactures which are discharged in *solution* are indeed essentially *mineral*, and this constitutes the first reason why so small an increase of organic impurity is found in the rivers.

The second cause which operates in this direction is the peculiar nature of the mineral matters so discharged. Sulphate of iron and alum, which are largely used in dyeing, are powerful disinfectants and precipitators of putrid or putrifying organic matter. The mineral acids, such as sulphuric and hydrochloric, which are also used in some form, have somewhat similar properties. The mordants employed in dyeing, as salts of tin, zinc, chromium, &c., have all an antiseptic effect, and we have found that the suspended matter of black-dye, which is a compound of iron and colouring matter, is itself a powerful deodorant and precipitant. The quantity of some of these compounds passing into the river is of course small, but the sulphate of iron and the insoluble black matter of the dye-water are discharged in enormous quantity, and these act most powerfully and beneficially in arresting the putrefaction of animal matters of sewage and other organic refuse, separating them from solution, and thus preventing their power of mischief.

We must not be misunderstood to be apologizing for, still less to be justifying, the condition of the West Riding rivers, but we do say most unreservedly that the dye-refuse serves as an antidote to the other refuse discharges of the district, and that were it not so the state of the rivers would be far more offensive in reality, though not to the eye, than it is at the present time.

We repeat that if, by proper precipitation, and by subsidence or mechanical filtration, the solid suspended matter of the dye-waste, together with the iron in solution, could be prevented from passing into them, the rivers of Yorkshire would at once assume a new character. But concurrently with any measure of this nature it would be imperatively necessary to act with the utmost stringency against the pollution caused by sewage and other putrid discharge, a pollution the injurious effects of which are now kept within limits by the discharge of manufacturing refuse; otherwise we should be relinquishing the antidote whilst remaining subject to the bane.

One great argument for the purification of the rivers up to an available point should not be passed over in closing the consideration of this question. Manufacturers require *clean* rather than *pure* water. They cannot get on with water which is fouled by solid suspended matter; but a certain proportion of salts, if that proportion be not excessive, and if it does not include iron or too much lime, is not greatly objected to.

If the water of the rivers could be brought back to a state of sufficient purity for manufacturing purposes it would again come into use for such purposes, and large quantities of purer water now consumed by trade would become available for domestic supply. Renewed purity of the rivers for manufacturing purposes would be synonymous with increased supplies of pure water for human consumption.

Defects of Existing Law relating to Rivers Pollution.

The law, as it at present exists, is only applicable to local and individual cases. There is no power of general application. One town or one manufacturer may be proceeded against, but there is no authority having the means and the power to deal with nuisances throughout an entire drainage area.

We found the law relative to the pollution of these rivers to be the subject of general and well grounded dissatisfaction. Theoretically, the law recognizes that protection is due to public and private rights in running water. It prohibits all public nuisance, and imposes upon each riparian proprietor the obligation of allowing running water to pass on in its course without obstruction or pollution. But a person, judging from the present appearance of the streams in the West Riding, would infer the contrary to be the law, and would conclude that there existed a general license to commit every

kind of river abuse. For, as we have shown to be the fact, the rivers and streams are polluted with sewage and dye-waste, and, except where special legislation for navigation purposes obtains, their course is obstructed by the casting in of solid rubbish. The cause of this variance between the law and the practice is to be found in the difficulties of enforcing the law and the exceptions which are allowed to it.

So far as river abuses affect only private rights, each individual is left to protect himself by putting the law in motion. An aggrieved proprietor has the option of bringing an action for damages in the Common Law Courts or of filing a bill in Chancery for an injunction. Either course is necessarily invidious, expensive, and doubtful in its result. It is invidious because neighbour is set against neighbour, and because it must seem unjust that one manufacturer should be proceeded against and mulcted for doing that which hundreds of others, who do not happen to offend a powerful neighbour, are doing with impunity. It is an expensive remedy. For the same money which is spent over a hardly fought litigation against a single manufacturer, a Conservancy Board, armed with proper powers, might for years keep safe from all abuse a long extent of the river with hundreds of manufactories situated on its banks. The expense incurred by the Aire and Calder Navigation in preventing solid materials from being cast into the *navigable* channel (for this is the limit of their powers) is very trifling indeed. Legal proceedings are also a very doubtful remedy. The plaintiff may prove that he has suffered injury from the pollution of the river and that the defendant has polluted the river above him; but this is not enough. The plaintiff has also to prove that what he has suffered has been caused wholly or in part by the special act of the defendant, which is always difficult—often impossible. For besides the defendant there is probably a multitude of manufacturers who, at various points higher up the stream, cast in liquid refuse from their works; these impurities are carried down by the current, and by the time that they reach the plaintiff's works they are all mingled confusedly together, and the offence of the defendant has ceased to be distinguishable. The plaintiff accordingly fails to establish his case.

Even where successful these private attempts to protect the river are but little gain to the public. Several instances have come before us where a manufacturer, sued for polluting running water, has brought the litigation to a close, not by ceasing to foul the river, but by simply removing the discharge into the river to a point below the works of the complainant.

Further, the law recognizes prescriptive rights to pollute running water and obstruct its flow, provided such abuse fall short of public nuisance. Such rights we do not hesitate to call privileged abuses.* A manufacturer who, in the exercise of a right so acquired, discharges into the river the solid and liquid refuse from his works may thereby do injury to the river to the extent of many times the money value of the right. But the loss to the public is too serious to be measured by a money standard. If some are permitted to pollute or obstruct the river, it is in vain that others abstain from abusing it. Thus by the maintenance of exceptions the law discourages those who are well disposed, and renders ineffectual voluntary combination, even upon a large scale, amongst manufacturers, to preserve the river. More than this, the law actually holds out a premium to those who abuse the river. A manufacturer is tempted to go on casting solid and liquid refuse into the river in order to establish a new right or to keep alive an old one.

The law prohibiting river abuse, when it amounts to a public nuisance, is not open to the same objection, because no length of toleration is held to justify a public nuisance. But the term "public nuisance" is a very equivocal one. In a manufacturing district no manufacturer is in danger of being indicted, still less of being convicted of causing a public nuisance, on the ground that the discharge of his dye waste renders the water of the river opaque, discoloured, unsightly, and quite unfit to drink, provided no smell is occasioned and there is no danger to public health. Again, in the neighbourhood of large towns it has come to be thought that a river foul with sewage is inevitable; inhabitants are reluctant to come forward as witnesses to denounce that to which they have become long familiar, and in like manner jurymen are slow to find such things to constitute a public nuisance. In the case of sewage pollution it is not usually difficult (as it is in the case of pollution from manufactory refuse) to trace the offence home, but, however serious the evil, it is very difficult to find a prosecutor. For the principal offenders are the governing bodies of large towns. These do not prosecute

* See a case decided by Lord Justice Cairns, reported in the "Times" of July 31, 1867. Appendix No. VIII., p. lxix.

one another for the reason that each is guilty of the same offence towards his neighbour, and they are rarely prosecuted by private persons because few are willing to bear the expense and odium of acting as public prosecutors. To institute legal proceedings against a large town with a view to compel it to adopt a different mode of disposing of its sewage, at a cost perhaps of many thousand pounds, is to provoke a wealthy adversary to a conflict in which every step will be contested. The expense of such a litigation generally far exceeds the value of the personal interest of any individual in the stoppage of the nuisance. Accordingly, whatever the inconvenience to the public, the nuisance continues unabated. Rich and poor alike submit to it as to a sort of destiny.

From these public nuisances, injury often of an unexpected character results to individuals. Two instances may be cited from those which, in the course of our inquiry, have been brought to our notice. Through the grounds of a Mr. Wood, situated on the outskirts of Pontefract, and in front of his house, runs what until recently was a clear pure stream of water. Two years ago the Street Commissioners of the town commenced to discharge sewage from the northern part of the town into this brook, and the result upon the brook where it passes through Mr. Wood's ground, is not only that the water is foul, but that the putrid deposits brought down by the stream choke up the channel and occasion a nuisance. From this nuisance Mr. Wood has no appeal except to law, and in aggravation he last year received a notice from the Mayor of Pontefract calling upon him to clear out "the offensive drain."

The other instance is that of the Bradford Canal. Bradford Canal is fed from Bradford Beck. The beck is deeply polluted by the sewage of the town, and the polluted water, when passed into the canal and ponded up in a stagnant condition, becomes a nuisance. The corporation, though recognizing the nuisance to be very serious, have abstained from taking proceedings against the Canal Company, doubtless feeling that the town and not the canal was to blame in the matter. However, the nuisance became so intolerable, that some individual townsmen have combined together, and by private subscription have instituted proceedings against the Canal Company. The Queen's Bench has pronounced that the Canal Company, whatever may be their statutory rights to draw water from the beck, are not justified in causing a public nuisance. And the Court of Chancery has issued an injunction, which practically prevents the Canal Company from drawing from the beck, whilst the beck is in its present polluted condition, and in consequence of which the canal has been in disuse since the 1st of May last.

Conclusions.

Where manufactures have been established and a large resident population has grown up as before stated, the greatest amount of pollution takes place, the area of country over which such form of nuisance is spread having no defined boundary other than the dividing ridges of such watershed and the shores of the sea. In order to prevent the Pollution and legally control the Management of rivers, their basins or watersheds must be placed under supervision irrespective of any arbitrary divisions of County, Parish, Township, Parliamentary, Municipal, or Local Government Act boundaries; or, indeed, of any artificially established division. Running waters flow on from their source to the sea, and if the upland waters are polluted by town sewage and by refuse discharged from manufactures, as in the West Riding of Yorkshire, the entire length of a river is necessarily polluted, and will require to be Conserved or protected. Towns situated midway or on the lower branches of rivers, as Leeds, Manchester, Salford, and many other places, will establish and carry out local improvements, and would clarify their sewage and other refuse fluid to little practical purpose, if the towns, villages and manufactories on the same river with themselves and its tributaries are not placed under restrictions against sending down pollutions. This state of things applies equally to villages and even to single mills and factories as to large towns: it prevents local authorities, as also manufacturers, from taking up the question of separate purification. Thus, for instance, the Corporation of Salford, which occupies one side of the river Irwell opposite Manchester, entertained the idea of intercepting sewers. Plans were prepared and estimates made, and the project was discussed, but was abandoned on the plea that money expended in Salford alone on such works would not accomplish the purification of the river Irwell so long as Manchester and all the great manufacturing towns and mills of Lancashire, situated on the river and its tributaries, continued to pollute the running waters of their respective

districts. Some towns have been placed under restrictions as to river pollutions by solids, and have been required to abate the intolerable nuisance caused, as at Birmingham and at Blackburn, where depositing tanks are at work; but in neither case is the requirement equitable, these towns being made the scapegoats for offences by no means confined to themselves. The river Tame, which flows through Birmingham, receives the pollutions from towns, mines, and manufactories situated above it on the South Staffordshire iron and coal-field. Blackburn in like manner, though in a much less degree, receives pollutions from manufactories beyond its area. Pollutions caused by sewage and by trades and manufactures ought, in our opinion, to be prevented, *at the cost of the communities and persons causing such pollutions.* At Croydon, at South Norwood, and at some other towns, it has been forbidden by injunction for the local authorities to pass town sewage into running waters below a defined standard of purity, and the result has been, after the failure of all other systems, a clarification of such sewage by irrigation, which not only proves successful for the purpose desired, namely to prevent river pollution, but in its operation is a source of profit to the ratepayers. However that be, the question of profit or loss in abating nuisances and in preventing either the undue pollution of the atmosphere, running waters or the seashore by town and house sewage, or by working mines and carrying on trades and manufactures, ought not too closely to be taken into account, as in some cases restrictive measures rigidly enforced would result in profit, whilst in others there might be a small loss, if that can be fairly called loss which is more than compensated by gain to the community. Towns can as well afford to pay for the means and appliances necessary to render sewage innocuous to running waters, as they can to pay for the sewers and drains which are necessary to their sanitary well doing. We have explained in this report that abuse and pollutions of running waters are of wide extent and affect entire watersheds, so that it may be inferred that any useful remedy must be capable of being applied as widely as the pollutions extend. Some districts are notoriously more polluted than others, as, for instance, those which we have just visited where the great woollen and worsted trades are established; there the abuses and pollutions of running waters have become almost intolerable, and even trade is seriously injured in consequence. The long catalogue of pollutions and of floodings, as set forth in the evidence and in the appendix to this report, indicates the extent to which such abuses may further grow if left uncontrolled. Every witness we examined admitted the existence of many great evils, and remedial measures are in the evidence over and over again suggested, the reiterated stipulations being, that such measures shall be as general as the trades to be affected by them, and that their enforcement shall be by Government authority.

One conclusion, therefore, forces itself upon anyone who honestly deliberates upon the existing state of things in regard to the rivers we have visited with a view to its permanent improvement. A stronger power than has hitherto been available must be brought to bear if the present abuse and pollution of streams is to be arrested, and Government supervision and inspection must enforce and strengthen the action of local authorities.

As previously mentioned, there is plenty of land in the Aire and Calder district suitable for sewage irrigation, and we have no experience of any town or locality where the application of that system would be impracticable. Should there be any place so exceptionally situated that the benefit of this system could not be secured by reasonable outlay, there the entire sewage should be so treated by mechanical deposition, aided by any available chemical process, that no portion of solid matter in suspension should pass into the streams, and that the effluent water should be as free from organic impurity as the best known method can make it.

All refuse from dyeworks, mills, factories, tanneries, breweries, malthouses, slaughterhouses, and the like, should be prevented from being cast into and polluting running waters.

No ashes, cinders, slag, waste-earth, mud from canals goits and reservoirs, road-scrapings, broken pottery and utensils, bricks and building rubbish, or any other solid calculated to impede the flow of water, raise the bed of the stream, or cause impurity, should be permitted to be cast in or so to be disposed on the banks of a river as to be carried in by its waters.

No water that has been used in washing, scouring, milling, fulling, &c., wool and woollen goods, should be allowed to pass into any running stream until all oil, grease, suspended matter and dirt, has been removed from it.

Water containing colouring matter from dyeing should be clarified, with or without chemical aid, by ordinary subsidence, by filtration through ashes or sand, or by

mechanical filtration as Needham's press, before being allowed to flow into any running water or river.

Ochrey water from coal workings, which is highly objectionable to manufacturers if passed direct into running waters, may be greatly improved by mechanical deposition and should be so treated.

We do not consider it desirable to define the exact modes of treating dye-waters and other waste products of manufacture, solid and fluid, as the modes of operation vary at different places. The cheapest and best mode at one place might not in any way be equally applicable at others; but the prohibition against the practice of casting in solids *may at once be general without any exception.*

Sewage interception is always practicable. Where it can be applied fresh to the land there is least nuisance and least cost to the ratepayers. Where the solids are extracted by mechanical deposition, there is pecuniary loss on the operation, and running streams receiving the effluent water are still polluted, the pollution being greater as the volume in the stream is relatively small. No arrangements for treating sewage are satisfactory except its direct application to land for agricultural uses.

It is for the interest of manufacturers as well as of riparian owners and the community at large that a preventive law should be equitably but rigidly applied. For such legislation the successful operation of Lord Derby's Act which has abolished the nuisance from alkali works affords a fitting and encouraging precedent.

We have shown in this report how, with advantage to all parties, the main elements of river obstruction and pollution in the West Riding of Yorkshire may be eliminated; it will be our duty to inquire in districts specially affected by other trades or by mining, whether there exist any obstacles, which we do not at present anticipate, to such a general system of River Conservancy for the country at large as suggests itself as most desirable for local application to the valleys of the Aire and Calder.

Our experience of the weakness inherent in unaided and uncontrolled local authorities as at present constituted convinces us that a central board appointed by a State department is necessary to the efficient protection of running waters. For instance, under the Local Government Act, 1858, a Local Board may be established; and, after having executed works on borrowed money, the ratepayers may decline to elect a board, or the members of such Local Board, after election, may decline to act, there being no power in the Home Office to compel them to do so: such power, however, will be absolutely necessary in any Conservancy Act, to enforce the prevention of river pollution.

Economy in the working of a central board for the conservancy of rivers might probably be obtained by enabling it to avail itself of such parts as may be applicable of the existing system of Government inspection, as of factories, mines, alkali works, fisheries, land drainage, &c.

In respectfully submitting this suggestion for the establishment of central authority we would guard ourselves against being supposed to ignore the sentiment which exists throughout the country in favour of local representative bodies, with power to levy and control such rates as may be sanctioned, and to perform all necessary works within their respective neighbourhoods.

Essential to the wellworking of our plan would be the parcelling of river basins into conservancy districts or areas and sub-areas, larger in agricultural districts where the duties would be light, by grouping together several river catchment basins, and smaller in manufacturing and mining districts where river pollutions and obstructions are more general and numerous, and where the operation of local boards and their officers would be more frequently required.

The duties of such central and district conservancy boards might be,—

1. To aid the Salmon Fisheries Commissioners.*
2. To prevent the obstruction of rivers and running waters by casting in of solids or flushing in of mud, as also all forms of river pollution.
3. To take cognizance of all existing weirs, mills, dams, river-walls, embankments, reservoirs, goits, culverts, drains, &c., and of any new works proposed which may affect streams.
4. To hear appeals in cases of local dispute as to works of any character affecting the condition and free flow of rivers.

* See Mr. S. Walpole's first report, enclosing answers to questions submitted by Mr. Ffennell with regard to pollutions among other injuries to fisheries. (*Sixth Annual Report of the Inspectors of Salmon Fisheries, ordered by House of Commons to be printed July* 15, 1867, 440.).

With this report we publish four sketch maps, intended to explain our suggestions in reference to the district of the Aire and Calder, together with tables of its area and population, and statistics of the local manufactures in which water is used and polluted.*

1. Sketch map of the basin of the river Ouse, showing the combined sub-area of the rivers Aire and Calder.
2. Geological map of the Aire and Calder basin, reduced from Professor Phillips' "Geology of Yorkshire."
3. Sketch map of the basin of the rivers Aire and Calder, divided into ten suggested sub-conservancy districts, each being a complete sub-catchment basin, having a principal town within it.
4. Sketch map of the drainage area of the river Colne and its tributaries (above its junction with the river Calder), having Huddersfield as the principal town in this watershed.

Our views upon the important question of the prevention of the pollution and obstruction of rivers will, we trust, as far as the valleys of the Aire and Calder are concerned, be sufficiently evident from the general tenor of this report and its concluding paragraphs.

As we are now, in obedience to Your Majesty's Commission, about to visit rivers specially polluted by other manufactures and by mines, we respectfully reserve the absolute recommendations which would appear to be in this place due from us, partly in deference to the express objection on the part of West Riding manufacturers, to any legislation which should not also be enforced upon the textile trade of other districts, and partly in the hope and expectation that, by postponement of final judgment to experience of other pollutions and localities, our Recommendations will be more valuable and more capable of general application to the improvement of the rivers of England.

All which we humbly certify to Your Majesty under our hands and seals.

(Signed) ROBERT RAWLINSON. (L.S.)
JOHN THORNHILL HARRISON. (L.S.)
J. THOMAS WAY. (L.S.)

RALPH A. BENSON, *Secretary.*
August 15, 1867.

* See Appendix No. IX., p. lxx.

APPENDIX.

APPENDIX No. I.

Floodings in the Rivers Aire and Calder Valleys, November 1866.

The following account of the disastrous flood which took place on the rivers Aire and Calder during the month of November 1866 is abstracted and condensed from local reports.—

On the 15th and 16th of November 1866 a general heavy rain commenced on the mountain ranges extending from Durham to Derbyshire, upwards of four inches of rain falling in some places during forty-eight consecutive hours. The Cal and the Der, united at Todmorden, rose above their banks and flooded houses and mills, Railway trains were stopped betwixt Todmorden and Manchester. In the flat district of the town cottages and mills stood in the midst of a vast sheet of water. The flood carried down sand, gravel, and ashes to spread them over land and gardens on both sides of the river below, spoiling the crops in many hundred cases. At Hebden Bridge roads, mills, and houses were flooded; women and children had to be removed by means of ladders from windows to escape drowning. The Hebble valley and the Black Brook valley were flooded and much damage suffered. River-side premises, cellars and houses were all under water; furniture and even provisions were floating about; sick people had to be removed in blankets; women carried their children to places of safety; fear and anxiety was expressed on every countenance. The manufacturers had many things which would float carried away, besides the damage done to buildings, machinery, and goods. At Huddersfield the rivers Holme and Colne, which have their junction at Folley Hall, were swollen to a great extent. A report was spread that Damhead reservoir had burst; this, fortunately, was not the case; adjoining lands, to the extent of many acres, were under water. Queen's mill was surrounded with water and flooded to such an extent as to imprison the workpeople for several hours. Riverside premises, roads, streets, yards, mill floors, cellars, and basements of shops and cottages were flooded so as to cause much damage and consequent loss. At Lockwood, the river Holme was in flood, and did much damage down the valley; at Dungeon mill, yards and mill floors were under water, and fires were extinguished; the water rose as high as at the bursting of the Holmfirth reservoir; fields and gardens were laid under water, and portions of river-wall washed down; the carriage road to Messrs. Bentley and Shaw's large brewery was two feet under water; the several large mills on the banks of the river were more or less flooded and injured; weaving-sheds were inundated, machinery and goods destroyed to a considerable value; steam-boiler fires were put out, and the mills had to cease working for several days, causing loss in wages to hundreds of working people. Lockwood baths were so much inundated that the occupants had to be removed. At Netherton the flood did much damage. At Bierley, part of a mill-dam was washed away. At Luddenden, mills and cottages were flooded, goods and furniture were damaged. At one mill a window had to be broken to remove a female from the interior. At Luddenden Foot, river-fence walls and railings were broken down; mill and shed floors were swamped with water and much damage done; timber, furniture (a chest of drawers), carcases of pigs, and other things were floated down the river. At Ripponden there had been river-walls built in places, but where no such protection was afforded, premises, mill floors, and cottages were flooded. Treadmill Bridge—a footbridge—was carried away, and four persons, a mother and three children, were drowned. At Sowerby Bridge the flood in the Calder rose higher than on any previous occasion, so that land on both banks, cellars, dwelling-houses, mill-floors, and yards were all flooded, causing great damage and loss; the flood carried down timber, tubs, barrels, carcases of pigs, and many other things; the gasworks were so flooded as temporarily to prevent the district being lighted until the waters subsided. In the holmes west of Sowerby Bridge much damage was done by the flooding of weaving-sheds, mill-floors, yards, and the basements of houses; looms, carding-engines, and other machinery were damaged, some piles of twist and pieces of cloth were washed away and others damaged. Prior to the erection of the new mills above the bridge inquiries had been made as to the range of floods, and the floors were thought to have been placed above this level, but this flood rose more than three feet higher than any one previously recorded, hence the flooding and loss. At Copley the river Calder flooded large areas of land, and caused much damage. At Sterne mill the basements were flooded to a depth of two feet six inches; all the holmes by the river side were covered with sand and mud; garden allotments were partially destroyed; the National School was flooded; boundary walls in fields parallel with the river were thrown down, and, in some cases, the stones were washed away. At Elland West-Vale the flood waters rose to the top squares of the windows of the old mill; and large quantities of goods were washed away and machinery damaged; large areas of farm land belonging to Major Waterhouse, M.P., were flooded and seriously damaged, by being covered with sand, silt, and rubbish washed on and deposited by the torrent; all down the course of the river great damage to land, mills, and other property was caused. At Brookfoot and Brighouse the land in the valley was flooded; further down the river the floors of new mills and new houses were placed under water. Broad Holme mill was flooded and much loss occasioned, the waters rushing across gardens and fields; many houses were inundated at Messrs. Sugden's old mill; horses had to be removed from the stables; Daisy-Croft, Mill Lane, and Clifton Bridge were flooded; in Bethel Street houses were flooded, fires were put out, and furniture floated about; at Victoria mill silk-cording engines were spoiled by water. Low mill, standing at the junction of the river and canal, was flooded to the ceiling, a water-wheel was smashed, soap and soda-ash melted, and blankets washed away; walls were washed down, the canal banks were injured, and a canal boat was carried on to the surface of the land, where it remained high and dry; at the Calder Dyeworks, vats and goods were damaged, and one house was swept away; at dyeworks belonging to Messrs. Burgess fires were put out, and much damage done; the mill belonging to the Messrs. Sugden had the entire length of river-wall carried away, as also a new house built for the engineer. At Mirfield the damage was very great, mill-floors, shops, and houses being flooded; canal boats were swept out of a building yard; a new branch railway was seriously damaged; six persons were drowned in attempting to drive over a bridge, and one man was washed out of the saddle and drowned in attempting to cross. In Dewsbury a dissenting chapel could not be used, and at the parish church the galleries only could be occupied, the floor of the church having been flooded more than three feet in depth; a blanket manufactory and bleaching-houses suffered much damage, a large number of finished blankets (part of a Government order) being damaged; some houses were swept away. In Calder vale, from the Dewsbury side to Thornhill, the damages were estimated at 100,000*l*. Uprooted trees, pigstyes, cowsheds, haystacks, and other floating wreck came down with the torrent of water. The damage at Wakefield was very great. Nearly every mill in the district had to cease work, the

corn warehouses and their contents suffered much injury ; pigs, cows, geese, and ducks were washed away. The Aire and Calder navigation works were seriously damaged, corn and grocery goods in the warehouse being destroyed; two barges were carried over the dam stakes ; the traffic between Wakefield and Manchester was stopped for several days and eight boats sunk at Hosbury cut. The losses in damage to buildings and property of various kinds amounted to several thousands of pounds.

In the valley of the Aire, along its whole course, damage was done to an extent as great as in the valley of the Calder. At Skipton the banks of the Leeds and Liverpool canal behind the castle were damaged, the reservoir was damaged, and 20 sheep were drowned. Near Cononley cattle were drowned ; at Bingley a wooden bridge was washed away ; at and below Keighley the valley looked like a vast lake ; near Dalton Mill much damage was done ; in the valley of the Worth there also occurred much damage from flooding; as the Aire received the flood waters of the various tributaries it became more terrible in its force and more destructive ; at Bradford, main sewers and the low parts of the town were flooded ; surface of streets being placed from four to five feet under water, having the appearance of rivers ; the Bradford and Leeds Railway was flooded in several places; on the Midland railway, at Esholt, near Apperley Bridge, a large stone viaduct of 10 arches was swept down with an engine and goods train upon it at this point ; the valley is wide and open ; if the foundations of the viaduct had been carried to a sufficient depth no such destruction would have taken place. The cost to the railway company in delay of traffic, and in reconstruction of the viaduct, must have been very great. At Leeds, quays, wharfs, and many streets, warehouses, shops, and dwelling-houses were flooded, in some places six feet deep ; boats were employed in the streets to remove persons from their deluged houses, or to convey light, fire, and provisions to those who preferred remaining in their chambers until the flood should subside. Barges were carried from their moorings and sunk against Leeds bridge, and several persons were drowned by the breaking down of a balcony passage above the same bridge. A tall chimney was undermined, and fell across some houses, destroying them ; the money losses in Leeds caused by this flood must have been very great ; individual losses were in some cases upwards of 1,000*l*. At Castleford the main streets were partially under water, houses were flooded, large breadths of land on both sides of the river were inundated, and boats were drifted away. In Wharfdale the lowlands were all flooded, roads rendered unpassable. At Otley a farmer was drowned ; near Ulleshelf thousands of acres were under water, and for two days imperilled the traffic of the North-Eastern Railway. From near Grimston upwards of 150 sheep were washed away. The total loss was locally estimated at from half a million to one million sterling.

APPENDIX No. II.

REPORT by Captain ARMYTAGE, Governor of West Riding Prison at Wakefield, on the use of EARTH-CLOSETS in SEPARATE CELLS of PRISONERS.

To the Rivers Pollution Commissioners.

West Riding Prison, Wakefield,

GENTLEMEN, 20th July 1867.

IN reply to your letter of the 1st instant, requesting me to give the result of our experience in working dry-earth closets in this prison, I beg to inform you that we have about 100 in use in cells which have not been provided with watercloset, and we are perfectly satisfied with them.

We do not, however, permit the prisoners to make water in them, but each prisoner is provided with an earthenware vessel for that purpose which is emptied every day. Had we not been so much engaged of late we should have had more earthclosets in use, as it is our intention to place earthclosets in all the cells in which waterclosets have not been provided.

I have, however, strong doubts about the earth-closets answering in the women's department. We shall try them, but I anticipate a failure.

We have about 740 waterclosets in use in the new prison (built in 1847) and (excepting in a few instances) the rest of the prison is without.

We pay a royalty of 2*s*. 6*d*. to the patentees for each earthcloset we make.

The cost, including royalty, may be roughly put down at 25*s*. each.

The only expense of maintenance would be in replacing the galvanised iron pan or scuttle when necessary. This would entail a cost of about 2*s*. per annum.

Probable annual cost of maintenance: One prisoner would be able to attend to the drying of the earth for any number of earthclosets up to 800. His labour and the cost of fuel for drying would not amount to more than 10*l*. or 12*l*. The cost, however, would materially depend upon the facility with which the earth could be obtained and the conveniences for drying. I should at present estimate the value of the soil after being once used at 10*s*. per ton. It seems to answer well for hand-dressings for grassland, onions, and potatoes.

In reply to your second question, wishing to know my opinion of the earthclosets as compared with the watercloset system, I think it best to let the present waterclosets remain and supply the remainder of the prison with earthclosets, and, by the time the present deficiency is made up, we shall be better able to form an opinion as to the advisability of replacing the waterclosets that get out of order with earth ones. Until such time I think it would be premature to consider the earth system as more than an experiment. The medical officers here do not object to the earth-closets, as they consider them far preferable to the pots the prisoners previously used.

You ask which system I would prefer in case it were made compulsory that the excrements of the prisoners should be kept out of Westgate Beck. You must be under a mistake in asking this question, as we have no drain from the prison into other than the large town drain, which has no connexion with Westgate Beck.

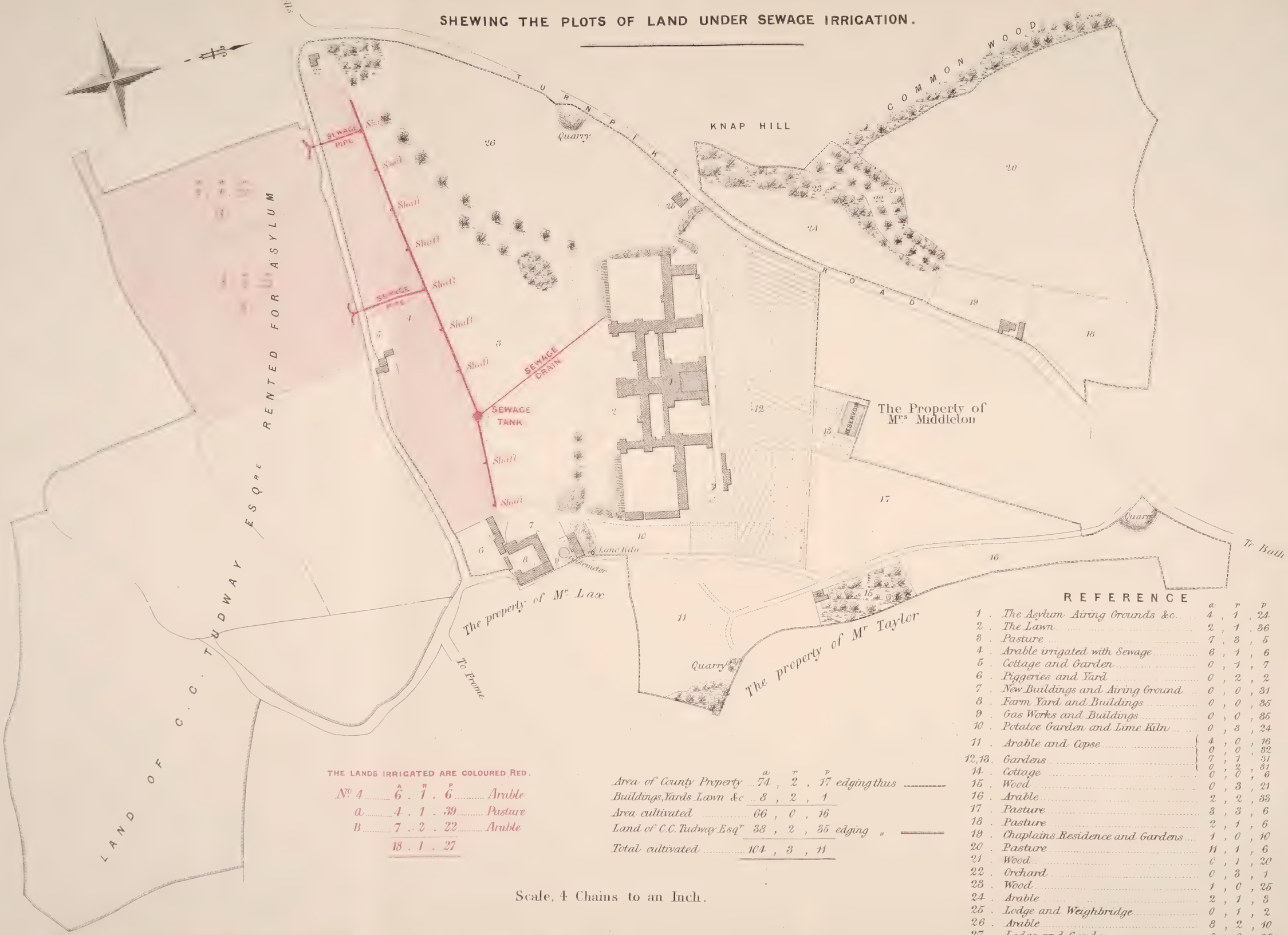
(Signed) G. ARMYTAGE, Governor.

CHINESE AND JAPANESE MANURE STORING AND FARMING.

In tropical climates moisture and heat promote fermentation to such an extent that refuse of all sorts rapidly becomes putrid, offensive, and dangerous to health. In India the natives go beyond the precints of their dwellings as did the Israelites during their sojourn in the wilderness. In China and Japan, manure is collected and stored by the inhabitants until it becomes putrid and offensive. The process is described in the following manner : "Both in towns " and in the country there are numerous receptacles " exposed for preserving the odious compounds until " wanted, on the highways at frequent intervals so as " to render such roads almost impassable to people " afflicted with the sense of smell, making it difficult " to get a fresh walk from one end of the land to the " other, unless it be on the edge of the craters." Sir Rutherford Alcock, K.C.B., states in a narrative of a three years' residence in Japan—"Exercise in the " country in China throughout the year, had this " terrible drawback of stink attached to it. In Japan, " except in spring, during the months of March and " April, there is little of the manuring to complain of. " The vegetables grown under the excessive manuring " are, however, either rank or tasteless, and their fruit " is no better; the cause may probably be in seed,

SOMERSET COUNTY LUNATIC ASYLUM

SHEWING THE PLOTS OF LAND UNDER SEWAGE IRRIGATION.



THE LANDS IRRIGATED ARE COLOURED RED.

	A	R	P	
Nº 4	6	1	6	Arable
a	4	1	39	Pasture
B	7	2	22	Arable
	18	1	27	

	a	r	p	
Area of County Property	74	2	17	edging thus ———
Buildings, Yards Lawn &c	8	2	1	
Area cultivated	66	0	16	
Land of C.C. Tudway Esqr	38	2	35	edging „ ———
Total cultivated	104	3	11	

Scale, 4 Chains to an Inch.

REFERENCE

		a	r	p
1	The Asylum Airing Grounds &c.	4	1	24
2	The Lawn	2	1	36
3	Pasture	7	3	5
4	Arable irrigated with Sewage	6	1	6
5	Cottage and Garden	0	1	7
6	Piggeries and Yard	0	2	2
7	New Buildings and Airing Ground	0	0	31
8	Farm Yard and Buildings	0	0	35
9	Gas Works and Buildings	0	0	35
10	Potatoe Garden and Lime Kiln	0	3	24
11	Arable and Copse	4	0	16
		0	0	32
12,13	Gardens	7	1	31
14	Cottage	0	2	31
		0	0	6
15	Wood	0	3	21
16	Arable	2	2	33
17	Pasture	3	3	6
18	Pasture	2	1	6
19	Chaplains Residence and Gardens	1	0	10
20	Pasture	11	1	6
21	Wood	0	1	20
22	Orchard	0	3	1
23	Wood	1	0	25
24	Arable	2	1	3
25	Lodge and Weighbridge	0	1	2
26	Arable	8	2	10
27	Lodge and Garden	0	0	39

Edward Stanford, lith. 6 Charing Cross.

" soil, and climate. It is stated of Japan, that " amidst great natural beauty and fertility the birds " have no song, the flowers have no scent, and fruit " and vegetables no flavour." Agriculture in Japan is encouraged to the utmost, much of the land is a light friable loam easily worked; in the valleys irrigation is provided for and the hills are terraced to a considerable elevation. Cropping and rotation of crops are thoroughly understood by the Japanese.

Rice is the staple food of the whole population and it is grown abundantly over the country generally wherever the nature of the soil will admit the possibility under the strongest compulsion of unwearied labour, irrigation and manuring combined. The water required for irrigation is plentifully supplied by the streams and rivulets to be met with in all directions. The Japanese farmer keeps his farm scrupulously free from weeds, neat, and in good order. Men, women, and children may be seen in the fields early and late. The manure in use is urine and night-soil. The farm labour is chiefly manual—a plough drawn by bullocks or ponies is used sometimes, but generally speaking mattocks and hoes are the implements by which the land is prepared and every part of the field labour performed.

R. R.

APPENDIX No. III.

The following description of Sewage irrigation works at the Somerset County Lunatic Asylum, together with plans of same, were furnished to the Commission by Arthur Whitehead, Esq., C.E., County Surveyor :—

SOMERSET COUNTY LUNATIC ASYLUM, SEWAGE IRRIGATION, June 29th, 1867.

DESCRIPTION of the PLAN adopted in the year 1848, and still in operation, at the Somerset County Lunatic Asylum, for utilising the Sewage of the Establishment.

1. The number of inmates of the asylum, including attendants, is at the present time 550.

2. The water supply is taken off from a stream in the valley, at a sufficiently high level to fill by gravitation the reservoir shown on the drawing, and the consumption for every household purpose is about 50 gallons per head, or 27,500 gallons daily.

3. Three-fourths of the rain water falling on the roofs and airing yards is intercepted and stored in tanks for household use, and the remaining one-fourth is discharged through the sewage drains into the sewage tank by gravitation.

4. The sewage drain, having its outfall in the sewage tank, communicates with the waterclosets, the baths, the laundry, the lavatories, and the kitchen, and with the roof: these were the arrangements made originally by the architect in the year 1846; since that time the superintendent, Dr. Boyd, has collected the rain water from three-fourths of the area of the building and yards, and utilised it for the laundry, the brewhouse, and for the house generally.

5. The lands on which the sewage is utilised are coloured red on the plan; the soil is "dolomitic conglomerate," and of the whole quantity (18a. 1r. 27p.) 13a. 3r. 28p. are arable, and 4a. 1r. 39p. are old pasture land.

6. The sewage tank is an ordinary brick-built chamber 15 ft. × 15 ft. × 18 ft., and the delivery drain is of brick, 4 ft. × 2 ft., and iron pipes convey the liquid from the upper arable land to the two fields on the other side of the road.

7. The application of the sewage to the land is managed by means both simple and inexpensive: shafts, in 4½ brickwork, are built at intervals along the main delivery drain, as shown on the plan; each shaft is provided with a "hatch" working in a frame, by means of which the sewage may be intercepted and made to overflow at any of the several shafts along the course of the main delivery drain.

8. By the kindness of Dr. Boyd, the medical superintendent of the asylum, under whose advice this work was done nearly 20 years since, I am enabled to record the following results :—

a. There has been no manure but sewage used on No. 4 piece of the arable land for 19 years; the quantity of cabbage, mangold, and Italian ryegrass grown on it each year is very large; cabbage frequently weigh 56 lbs., and some have been cut weighing as much as 70 lbs.; the roots of mangold weigh from 17 lbs. to 23 lbs., and the Italian ryegrass has been cut four times between March and October, and seeded once; the produce per acre is 50 tons, and the land shows no sign of depreciation. The sewage has been extended more recently to the other two pieces of land with similar success.

b. As to the effect in a sanitary point of view, I can state nothing so satisfactory as the words of Dr. Boyd himself, recorded in one of his recently published reports. He says, "No unpleasant " odour is at any time perceptible from this " sewage, unless by going close to the tank or " shafts, and by the time the sewage has passed " off into the ground, a few feet distant, it is " deodorised." I have myself, this very warm day, walked over the land over which the sewage was flowing, and I am able fully to confirm this statement of Dr. Boyd's. Again, to quote Dr. Boyd's report, "No ill effects, as regards " the health of the patients or others in the " establishment, however, occurred from the " sewage; the apartments of the superintendent " are nearest to the sewage tank. It has been " stated that in one asylum where the sewage " was used on the land, several fatal cases of " dysentery had occurred, which were attri- " buted to this source. It is probable that " other causes may have been overlooked, or " that the nature of the soil is such that it " requires to be broken up, if impervious, to " deodorise the sewage. If irrigation with the " sewage were the sole cause, it is most likely " that disease would have occurred here in the " course of 18 years, but neither dysentery nor " fever have, thank Providence, ever prevailed. " Nearly all cases have been carefully examined " after death, and notes of the post-mortem " appearances, in each case, given in the annual " reports."

9. Much of the work having been done at intervals, the cost of it cannot be given with accuracy, but the expense of the tank, delivery main, shafts, and fittings would not exceed 70*l.*, and the working expenses are almost nil.

10. I believe that, with some modifications and inexpensive alterations, we shall obtain better agricultural results on our farm. In a sanitary point of view the medical testimony is most satisfactory, and I think the Chairman of the Committee of Visitors would be willing to confirm these statements.

11. There is no reason whatever why the utilisation of sewage should not proceed *pari passu* with the generation of sewage; under no circumstance can it be anything but a question of expense; under some circumstances it is clearly a question of profit; under all circumstances it is a question of true economy.

(Signed) ARTHUR WHITEHEAD, Civil Engineer,
County Surveyor of Somerset.

APPENDIX No. IV.—SEWAGE IRRIGATION.

List of Questions relative to Sewage Irrigation, submitted by the Rivers Pollution Commissioners to the County Surveyor of Durham.

County of Durham.—Sedgefield Asylum Irrigation, 1867.

Answers to Questions contained in a Letter from the Rivers Pollution Commission, dated July 1st, 1867, a Copy of which is prefixed to this Report and each Question numbered.

1. Ground plan of the county asylum, and of the land irrigated with sewage and waste-water from that establishment, as also other information relative to population, &c.?

1. A plan is enclosed showing plot A, containing 10a. 0r. 37p. of old grass land to which the sewage was applied in the year 1863, with metal piping and hydrants or standpipes, shown thus, —⊕— , from the collecting-tank F. by gravitation; plot B, also old grass, containing 11a. 2r. 35p. to which the sewage was applied in the same manner by the same means in the year 1864; plot C, of garden and ground, containing 9a. 3r. 33p., to which the sewage was applied in the year 1864, by pumping from the tank F, by an engine (used for many other purposes in the workshops G.); these pipes and hydrants are placed much nearer than on the grass-land, on account of not damaging the crops by the moving of the hose, (used in all cases for distributing the sewage on the land); plot D, containing 13a. 3r. 14p. is arable land, and the sewage is proposed to be applied to this plot as well as to plot E, containing 20a. 2r. 18p. of old grass, at some future time, by gravitation and metal pipes, as applied to plots A and B.

2. Number of persons whose sewage is dealt with?
3. Volume of water used per head?
4. Volume of surface water admitted into sewers?
5. Area of land irrigated?
6. Mode of applying the sewage?

2. Number of persons, 503.
3. About 25 gallons per head.
4. None.
5. 32 acres, nearly.
6. By metal pipes, fitted with screw-caps as plugs, at the distances apart shown on the different plots thus —⊕— ; the whole sewage is shut off from access to the pipes by a 4″ valve at the tank, and when so shut off the hose can be detached from one plug and attached to another, and when so fixed the valve re-opened till the whole land has been brought under the scope of the hose and so irrigated.

7. First cost of irrigation works?

7. The cost of irrigating plot A was per acre, 11*l.* 7*s.* 4*d.* Plot B 8*l.* 15*s.* 0*d.* per acre. * Plot C 14*l.* 0*s.* 0*d.* per acre (including pump and section pipe).

8. Annual cost of management of sewage?

8. The sewage is applied by the patients under the direction of the farm steward, and there is no cost except the keeping in repair the hose, which is a mere trifle.

9. Description of crops grown?
Value of do.?

9. The crops grown on plots A and B are old grass used as pasture a portion of the year, and meadowed afterwards; these fields before being irrigated produced very poor crops, indeed almost nothing, but now produce at the first crop (after only having been freed as a pasture for six weeks) as follows:

Plot A produced 3 to 3½ tons of hay per acre, and plot B, 2 to 2½ tons; another crop will be got off each, which will probably produce on plot A a ton and a half, and on plot B one ton per acre; the fields are after this pastured by sheep till the May following. According to these crops the value of the produce will be about as follows:

Plot A (say average) 4½ tons	£	*s.*	*d.*
of hay at 6*l.* - -	27	0	0
Pasturage, say - -	1	10	0
Per acre	£28	10	0

Plot B (say average) 3¼ tons	£	*s.*	*d.*
of hay at 6*l.* - -	19	10	0
Pasturage, say - -	1	5	0
Per acre	£20	15	0

The produce of Plot C, the garden ground is most remarkable, and is spoken of by everyone in this neighbourhood acquainted with agriculture; the produce is principally consumed in the asylum, but of late years, since the sewage has been applied, a great quantity of surplus garden produce has to be disposed of to parties coming with their carts a distance of 10 to 12 miles, and purchasing the same for re-sale at the different markets and colliery villages.

The crops that seem the most benefited by the irrigation are as follows:

The cabbage tribe,
Celery,
Turnips,
Rhubarb,
Beans, &c., &c.

In fact vegetables of every description where sewage is applied are at all times most luxuriant and productive, and when the sewage, for any reason, is not so applied they at once slacken in their growth, and in a few days (only a narrow walk dividing the compared plots) are nowhere in the race.

As an instance of the value of a crop of cabbages now on the ground they are being sold wholesale to parties leading them 10 or 12 miles to the adjoining towns (and they then re-selling them) at the rate of 100*l.* per acre, *i.e.* at 12*d.* per dozen, they are re-sold at 18*d.* per dozen, or at the rate of 150*l.* per acre.

By proper rotation of garden crops, from 1¼ to 1½ crops may be got off the land per annum, so that the produce of each acre per annum will be equal in value to from 180*l.* to 200*l.*

The land irrigated is a free working loamy soil, overlying 10 or 12 feet of sandy porous gravel.

Durham, July 19, 1867. (Signed) William Crozier, M.I.C.E.

* Pipes laid much closer, being garden ground.

DURHAM COUNTY LUNATIC ASYLUM AT SEDGEFIELD.

SHEWING THE PLOTS OF LAND UNDER SEWAGE IRRIGATION.

REFERENCE.

THE LAND TO WHICH SEWAGE IS APPLIED COLOURED RED.

		A.	R.	P.
A.	Old Grass Land	10	0	37
B.	..... Do.	11	2	35
C.	Garden Ground	9	3	33
		1	2	35

THE LAND TO WHICH IT IS INTENDED TO APPLY SEWAGE.

D.	Arable	33	3	14
E.	Old Grass Land	20	2	18
		54	1	32
	Total	66	0	17

Scale of Feet.

100 0 100 200 300 400 500 1000 Feet

Stanford's Lithographic Estabt Charing Cross S.W.

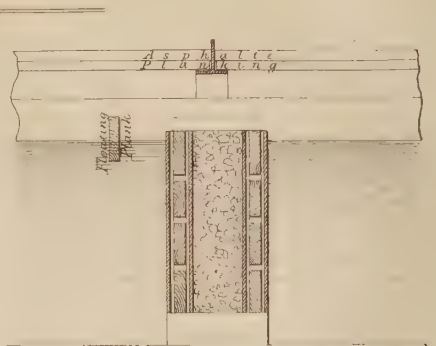
BLACKBURN.

SEWAGE OUTLET WORKS.

DETAILS.

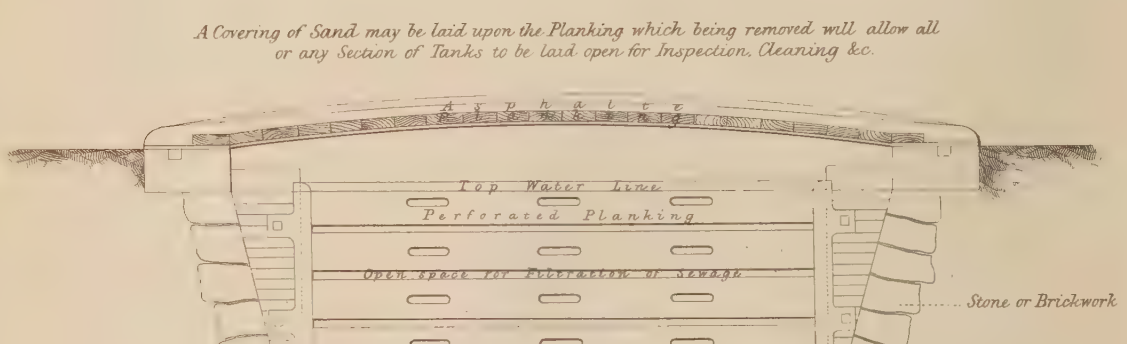
SECTION OF GIRDER.

⅛ Real Size.



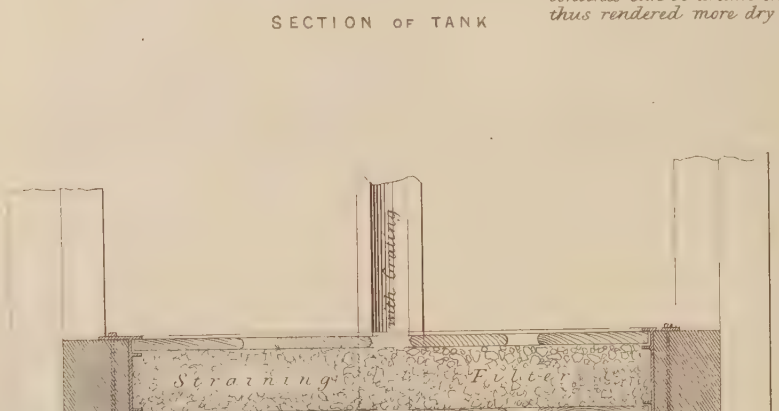
SECTION OF FILTER.

A Covering of Sand may be laid upon the Planking which being removed will allow all or any Section of Tanks to be laid open for Inspection, Cleaning &c.



SECTION OF TANK

*By means of this Channel the whole of the liquid contents can be drawn off and the solid deposits thus rendered more dry & easier of removal.



PLAN OF FILTER.

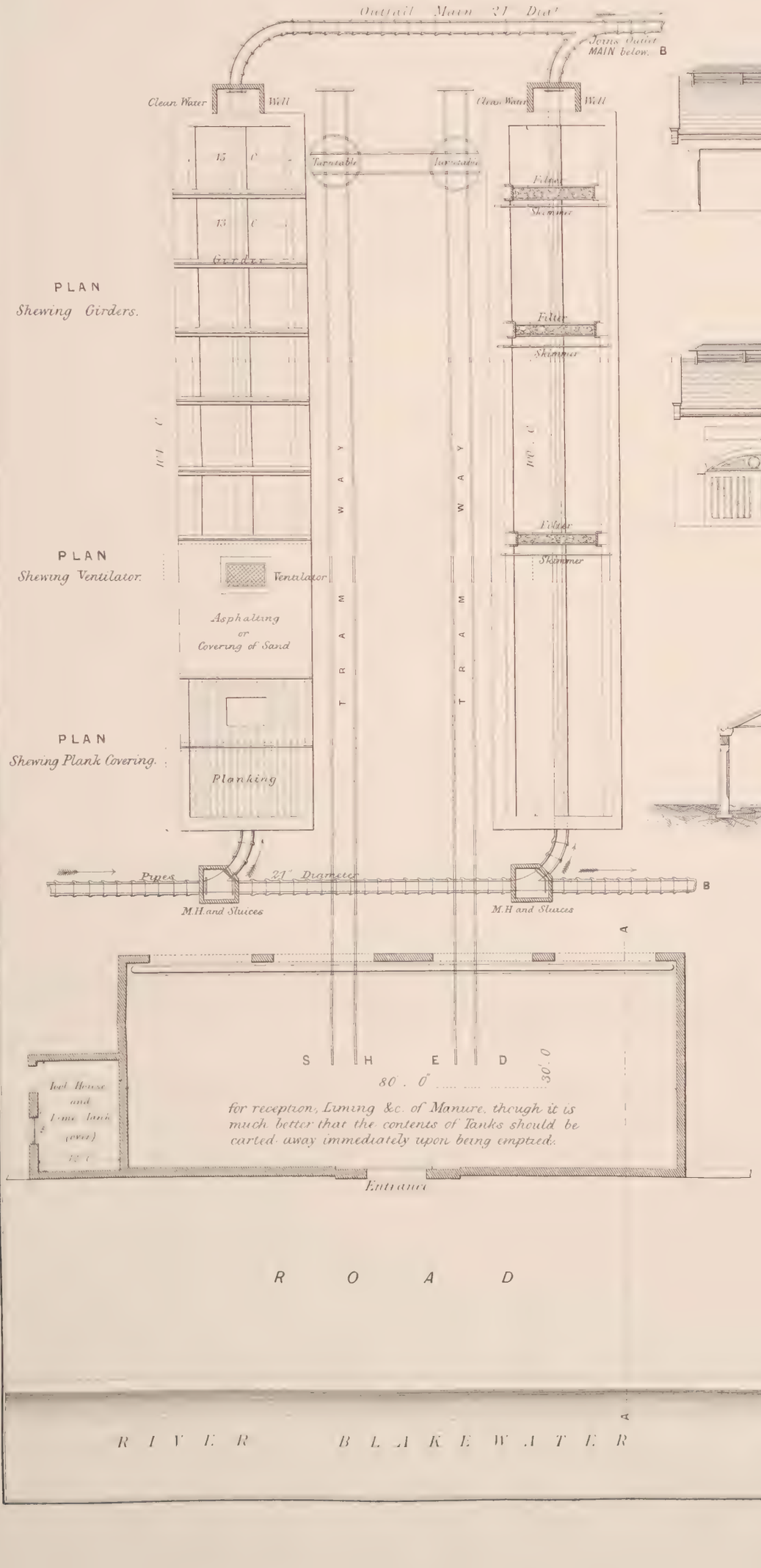
Scale 4 Feet = 1 Inch.

Stanford's Lithographic Estab.t Charing Cross S.

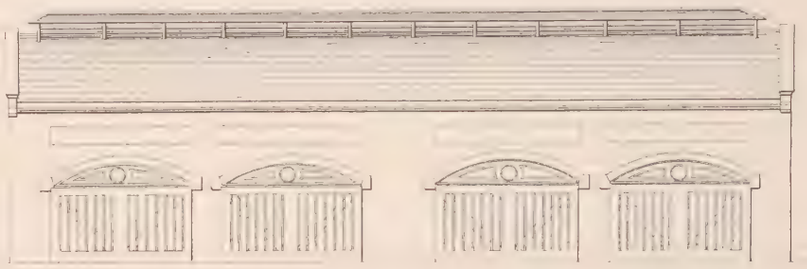
BLACKBURN.

SEWAGE OUTLET WORKS.

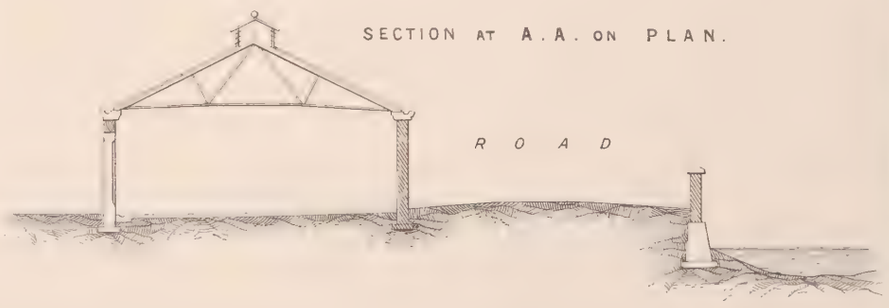
FOR INTERCEPTING SEDIMENT.



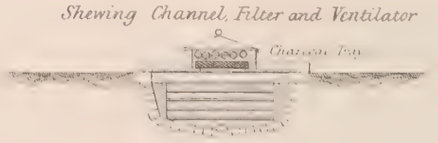
ELEVATION OF SHED (No 1.)



ELEVATION OF SHED (No 2.)



CROSS SECTION OF TANK.



Scale 20 Feet — 1 Inch

Stanford's Lithogr.rs &c. Estab.t Charing Cross. S.W.

APPENDIX No. V.

Blackburn Sewage Outlet Works.

The following description of the sewage outlet works at Blackburn, together with the accompanying plans, were furnished to the Commissioners by Joseph Brierly, Esq., C.E. :—

Blackburn, September 14th, 1866.

The value and the necessity of a sufficient and proper arrangement of "storm outlets" has been proved here during the past month; heavy rains have ested the sewers, and the main outfall 6.0 × 4.0 has been surcharged, shooting out its contents at full bore, and with immense force. By proper attention to the "storm outlets" all danger and inconvenience has been avoided.

The tanks are constructed on the Worksop model, —open trenches with brick or stone bottom and sides. They were set to work three weeks ago, and are now being emptied. In this period of time there has been accumulated (and arrested from flowing into the river) a quantity of solid refuse and sewage matter, estimated at 160 tons, consisting of road grit, the varied ejects from dwellings and W.C. refuse. This must form a very rich manure, and will be sought after.

I have carefully watched the working of the tanks with much interest.

The effluent water was not so clear as could be desired, but still the fact of arresting 160 tons of solid matter in three weeks, or at a rate of about 2,700 tons per annum, shows what has been done towards improving the river, and I have no doubt that the additional means of filtration, &c., which I have shown on plans, and which are now being fitted up, will very much improve the condition of the water as it leaves the tanks.

(Signed) Joseph Brierley, C.E.

APPENDIX No. VI.

Previously to framing our report, we requested from about 60 of the leading manufacturers answers to the following queries. We received 28 replies, the substance of which are tabulated in pages

Rivers Pollution Commission.—Inquiry into the state of the Rivers Aire and Calder and their Tributaries, 1866-67.

Queries relating to the Woollen and Worsted Trades.

1. About what weight of wool do you use in a year ?
2. How much of this wool do you wash ?
3. Do you use soap or alkali as well as urine in washing the wool ; if so how much ?
4. How much water in gallons is used in washing ?
5. About how much wool by weight do you dye, and what colours principally ?
6. About what value of dyestuffs do you use annually ?
7. What quantity of water do you use in the dye vats, and where does the waste water flow ?
8. Do you put oil to the wool before working it, and if so, what oil and about to what value per annum ?
9. About what weight of waste wool do you produce in carding, and what becomes of it ?
10. Do you wash the goods ? and if so, do you buy or make soap ? About how much, and to what value per annum ?
11. What quantity of water do you use in washing the goods, and what water, river or other water ?
12. Are the soapsuds made on your works treated for recovery of grease ? and if so, by yourself or by a contractor ?
13. What do you gain by the extraction of the grease ?
14. Are the whole washings treated, or only the first flow ?
15. Does the water from the grease process pass away clear, or how nearly so ?

The answers are tabulated, pp. lxii—lxvii.

APPENDIX

QUERIES relating to the WOOLLEN and WORSTED TRADES sent to the MANUFACTURERS and DYERS engaged Lockwood, Mirfield, Mold-Green, Rastrick, Saltaire, Skipton,

			1.	2.	3.	4.	5.									
No.	Name of Manufacturer.	Residence.	What Weight of Wool do you use per Annum?	How much of this Wool do you wash per Annum?	Do you use Soap or Alkali as well as Urine in washing the Wool? If so, how much per Annum?	How much Water per Annum is used in washing?	Weight of Wool, and of what Colours dyed, per Annum?									
							Weight in lbs.	Blue.	Black.	Brown.	Crimson.	Drab.	Green.	Red.	Scarlet.	Yellow.
1	Armitage Bros.	Huddersfield.	347,000 lbs.	267,000 lbs.	No soap, but soda and urine.	- - - -	167,000	+	+	—	—	—	—	—	—	—
2	Akroyd, James, and Sons.	Copley Mills, Skircoat, Halifax.	Nearly 343,000, the bulk of the wool used here having been washed at the other works in the borough of Halifax, and included in answers given from there.	343,000 lbs.	24,000 lbs. of soap, 10,500 lbs. of alkali. No urine.	5 to 600,000 gallons.	None -	—	—	—	—	—	—	—	—	—
3	Bates, John -	Dewsbury	350,000 lbs.	Spin wool unwashed. Scour and wash all wool produced.	No urine. About 15 tons of alkali and 3 tons of soap.	Unlimited: quantity not known.	290,000	+	+	+	+	+	+	+	+	+
4	Barker, R. H., & Co.	Wakefield	1,000,000 lbs.	Nearly the whole.	Soap, but not urine.	14,000,000 gallons.	280,000	+	+	+	—	—	—	—	—	—
5	Brooke, Henry	Huddersfield.	170,000 lbs.	127,000 lbs.	Use 8 cwt. of alkali.	About 300 gallons for 60lbs. of wool, that is 635,000 gallons.	About 115,000.	—	+	—	—	+	—	—	—	—
6	Brooke, John, and Sons.	Huddersfield.	In 1865 we used 506,500 lbs.; in 1866 we used 549,162 lbs.; in 1867, up to June, rather more than in the corresponding time of 1866. The average of three years, 535,000 lbs.	The whole	Soda occasionally used, but to a very small extent, and may be considered quite an exception.	About 78,000,000 gallons.	Nearly the whole quantity in wool or cloth is dyed on our premises.	+	+	+	—	+	—	—	—	—
7	Clay, Daniel -	Sowerby Bridge.	1,176,000 lbs. -	324,000 lbs.	38,400 lbs. of soap; 8,624 lbs. of ashes.	664,000 gallons	72,000	+	+	+	—	—	—	—	—	—
8	Clay, J -	Rastrick -	- - -	- - -	- - -	- - -	- - -	—	—	—	—	—	—	—	—	—
9	Clough, John -	Keighley -	750,000 lbs. -	660,000 lbs.	Soap and its equivalent in alkali and oil, but no urine; equal to 56,000 lbs. of soft soap.	Not known -	None -	—	—	—	—	—	—	—	—	—

NOTE.—The + in the above columns is placed opposite the names of the manufacturers and dyers to denote the colours they dye.

No. VI.

therein in the Towns of Bingley, Bradford, Dewsbury, Halifax, Honley, Huddersfield, Keighley, Leeds, Sowerby-Bridge, and Wakefield, with the Answers received as under.

6. What Value of Dyestuffs do you use per Annum?	7. What Quantity of Water do you use in the Dye Vats per Annum, and where does the waste Water flow?	8. Do you put Oil to the Wool before working it? If so, what Oil, and about what Value per Annum?	9. What Weight of waste Wool do you produce in carding per Annum, and what becomes of it?	10. Do you wash the Goods? If so, do you buy or make Soap? How much, and what Value per Annum?	11. What Quantity of Water do you use per Annum in washing the Goods, and what Water, River or other?	12. Are the Soapsuds made on your Works treated for Recovery of Grease? If so, by yourself or by a Contractor?	13. What do you gain by the Extraction of the Grease per Annum?	14. Are the whole Washings treated, or only the first Flow?	15. Does the Water from the Grease Process pass away clear, or how nearly so?
2,350*l.*	Waste water flows into river.	Yes. Gallipoli, 1,460*l.*	About 62,400 lbs. We work it up again.	Yes. Buy soap, about 17,000lbs., in value 280*l.*	Spring, but some of river water.	Yes, partly by a contractor.	30*l.*	Not entirely	Not quite clear.
None	None	Yes. Olive, 250*l.*	About 15,000 lbs. waste and sand or dust; the former sold, the latter used as manure.	Wash yarn. Buy soap about 7,200 lbs., in value say from 90*l.* to 100*l.*	300 to 400,000 gallons in washing the yarn. Spring water and water condensed from steam.	No	Nil.	—	—
1,200*l.*	470,000 gallons, waste water into river.	Yes. Rape, 450*l.*	50,000 lbs. Sold for manure.	Wash yarn. Buy soap, in value 260*l.*	Unlimited; river water.	No	The grease is not extracted.		The waste from all processes flows into river.
5,000*l.*	2,200,000 gallons.	Yes. Gallipoli, 3,000*l.*	35,000 lbs. Sold to waste dealers.	Yes. Buy soap, 89,600 lbs. in value 700*l.*	4,700,000 gallons; river water, part filtered.	Suds from yarn and worsted are so treated by a contractor. Suds from wool-washing are not, but flow into river.	About 100*l.*	The whole washings.	Not clear.
300*l.*	520,000 gallons, waste into river.	Yes. Gallipoli, 740*l.*	About 56,000 lbs. Sold to oil extractor and maker of artificial manure.	Yes. Buy soap, about 14,224 lbs. in value 214*l.*	Quantity not known; part from canal, part from bore-hole.	Yes, by a contractor.	30*l.*	Only the first flow.	The water does not pass away clear. It may be compared to the water in the vats during the second washing of the wool.
About 6,200*l.*, *i.e.*, about 4,800*l.* indigo, 1,400*l.* dyewoods and chemicals.	About 3,756,000 gallons, waste into river Holme.	Yes. Olive, 2,850*l.*	After reserving the best waste, say 3½ cwt., for our own use in manufacture, we sell about 15 cwt. of waste per week. Total waste per annum produced, 107,124 lbs. N.B.—This is carding waste only, not ends from subsequent process.	Yes. Buy soap, 40,320 lbs. in value 580*l.*	62,600,000 gallons. No river water is used. Three-fourths of supply from a bore-hole, and the remaining part from a stream flowing through our property.	Yes, by a contractor.	Nothing. The amount paid to us by the contractor is 55*l.*, but that is absorbed by the expense of steam, &c.	Only the first flow.	Not nearly so at all.
3,000*l.*	70,000 gallons, waste flows into river.	Yes. 14,500 gallons, 3,020*l.*	51,800 lbs. of the best sort sold for mixing with the wool again, 80,640 lbs. of the lower sort sold to a grease extractor.	Yes. Buy soap 35,840 lbs. in value 480*l.*	75,000,000 gallons; principally river, but spring water when we can procure it.	Yes, by a contractor.	About 150*l.*	Only the first flow.	Pretty clear.
The value of the dye stuffs will not exceed 500*l.* Most of the valuable colours are dyed elsewhere, and only cleaned on the premises.				Yes. Buy soap, 58,000 lbs. in value 600*l.*	About 2,504,000 gallons of well water, say 5,008,000 gallons from stream, total 7,512,000 gallons, but this is variable as the supply from the stream is uncertain.	No, they are too much diluted to be of any value.	—	—	—
Nil	None	Yes. Gallipoli, 650*l.*	None	No	None	Not yet, but we have erected buildings for the purpose.	—	—	—

Queries relating to the Woollen and

No.	Name of Manufacturer.	Residence.	1. What Weight of Wool do you use per Annum?	2. How much of this Wool do you wash per Annum?	3. Do you use Soap or Alkali as well as Urine in washing the Wool? If so, how much per Annum?	4. How much Water per Annum is used in washing?	5. Weight of Wool, and of what Colours dyed, per Annum?								
							Weight in lbs.	Blue.	Black.	Brown.	Crimson.	Drab.	Green.	Red.	Scarlet.	Yellow.
10	Crowther, Alfred.	Lockwood, Huddersfield.	500,000 lbs.	All - -	Urine only -	36,000,000 gallons.	We dye all or nearly so.	+	+	—	—	—	—	—	—	—
11	Crosland, George, and Sons.	Lockwood, Huddersfield.	600,000 lbs.	12 per cent.	Alkali and urine.	1,600,000 gallons.	400,000 lbs. per annum.	—	+	—	—	—	—	—	—	—
12	Dent, R.	Wakefield	- - -	- - -	About 7,840 lbs. of soap and 16,800 lbs. of soda and soda ash.	About 32,000,000 gallons.	- - -	—	—	—	—	—	—	—	—	—
13	Dewhurst, John and Sons.	Skipton -	We are not users of wool until after it is spun into woollen or worsted yarn.	- - -	- - - -	- - - -	None -	—	—	—	—	—	—	—	—	—
14	George, T. W., and Company.	Leeds -	- - - -	- - -	- - - -	- - - -	- - -	—	—	—	—	—	—	—	—	—
15	Holdsworth, J., and Sons.	Wakefield	- - - -	3,000 pieces, 5,600 lbs. of wool or waste.	No - - -	- - - -	3,000 pieces. 5,600 lbs. of wool or waste.	+	—	—	—	—	—	—	—	—
16	Howgate, Jas., and Sons.	Mirfield -	1,080,000 lbs. Wool and shoddy.	We buy our wool washed, except a very small portion.	Urine and alkali.	- - - -	240,000 lbs.	—	+	+	+	—	+	+	—	+
17	Ingham, Edward.	Halifax -	- - - -	- - -	- - - -	- - - -	3,505,600 lbs.	+	+	+	+	+	+	+	+	+
18	Kirk, Joseph M.	Halifax -	- - - -	- - -	No urine. About 22,400 lbs. of soap and 89,600 lbs. of soda ash.	- - - -	No wool -	+	+	+	+	+	+	+	+	+
19	Marriner, Edward.	Keighly -	960,000 lbs.	All - -	Soap. 124,800 lbs.	2,504,000 gallons.	None -	—	—	—	—	—	—	—	—	—
20	Oates, Ingham, and Sons.	Bradford -	1,800,000 lbs.	All - -	112,000 lbs. -	150,000,000 gallons.	1,200,000 lbs.	+	+	+	+	+	+	+	+	+
21	Salt, Titus, Sons, and Company.	Saltaire -	5,000,000 lbs.	3,823,000 lbs.	Soap 577,560 lbs., alkali 10,000 lbs. No urine.	4,000,000 gallons.	200,000 lbs.	+	+	+	+	+	+	+	+	+
22	Sugden, Jonas, Brothers.	Keighley -	About 1,000,000 lbs.	About 250,000 lbs.	Soft soap, about 40,000 lbs.	250,000 gallons.	Do not dye	—	—	—	—	—	—	—	—	—

NOTE.—The + in the above columns is placed opposite the names of the manufacturers and dyers to denote the colours they dye.

WORSTED TRADES, &c.—*continued.*

6. What Value of Dyestuffs do you use per Annum?	7. What Quantity of Water do you use in the Dye Vats per Annum, and where does the waste Water flow?	8. Do you put Oil to the Wool before working it? If so, what Oil, and about what Value per Annum?	9. What Weight of waste Wool do you produce in carding per Annum, and what becomes of it?	10. Do you wash the Goods? If so, do you buy or make Soap? How much, and what Value per Annum?	11. What Quantity of Water do you use per Annum in washing the Goods, and what Water, River or other?	12. Are the Soapsuds made on your Works treated for Recovery of Grease? If so, by yourself or by a Contractor?	13. What do you gain by the Extraction of the Grease per Annum?	14. Are the whole Washings treated, or only the first Flow?	15. Does the Water from the Grease Process pass away clear, or how nearly so?
2,600*l.*	2,000,000 gallons waste flows into river.	Yes. Olive. 4,000*l.*	Weight not known. Clean waste we use again in low goods.	Soap used in milling only, in value 600*l.*	10,000,000 gallons; all from river.	Yes, by contractor.	70*l.* - -	Only the first flow.	Not nearly clear.
1,400*l.*	640,000 gallons; waste flows into river.	Yes. Olive. 2,300*l.*	80,000 lbs.; sold for the purpose of extracting the oil.	Yes. Buy soap 40,000lbs., in value 700*l.*	9,000,000; all from river.	Yes, by contractor.	40*l.* - -	Only the first flow.	Very dirty.
3,000*l.*	6,260,000 gallons; waste water flows into river Calder.	- - -	- - -	Yes. Buy soap, in value 100*l.*	About 32,000,000; chiefly water from river Calder.	No.	—	—	—
About 1,200*l.* for dyeing cotton warps.	About 3,756,000 gallons; waste flows into Eller Beck.	- - -	- - - - -	No.	—	—	—	—	—
- - -	About 6,260,000 gallons; waste flows into river Aire.	- - -	- - - - -	We use a very small quantity of soap; and scarcely any in scouring.	About 46,950,000 river water, and 31,300,000 well water.	The quantity is so small as not to be worth collecting.	—	—	—
12,000*l.*	Waste water flows into river.	- - -	- - - - -	- - -	About 37,530,000; river water.	—	—	—	—
1,500*l.*	18,780,000 gallons; waste flows into river.	Yes. Olive and Gallipoli, 60 tons, in value 3,500*l.*	112,000 lbs.; sold to extractors.	Yes. Buy soap 89,600 lbs., in value 1,389*l.* 2*s.* 11*d.*	About 7,825,000; river water.	Yes, and by a contractor.	55*l.*	The whole of the first and part of the second.	Very clear.
25 to 30,000*l.*	78,250,000 gallons; waste flows into sewers.	No.	- - - - -	Yes. Buy soap 14,400 lbs., in value 150*l.* to 170*l.*	Spring water -	No; the soapsuds with other liquids flow into sewers.	—	—	—
15,000*l.*	31,300,000 gallons; waste flows into Hebble Brook.	Nil.	Nil.	Yes. Buy soap, in value 400*l.*	109,550,000; principally from river, part from springs and waterworks company.	No.	Nil.	—	—
- - -	- - -	Yes. Gallipoli, in value 250*l.*	About one-third, which is sold to short wool dealers.	Yes. Amount included in answer to No. 3.	1,252,000; pure spring water, the river being foul.	Yes, by a contractor.	2*s.* per pack on the soap used.	The whole	Not clear.
30,000*l.* We burn all our spent woods.	The whole quantity of water is used in scouring, dyeing, and washing off. Waste flows into Bradford Beck.	No.	- - - - -	Yes. Buy soap, 1,200*l.*	The water we use is partly supplied by the waterworks company, but principally from wells. We do not use the river water, it is too dirty.	No.	—	—	—
2,000*l.*	Cannot say. The waste flows into river.	No.	All is sold - -	Only wash wool and yarn. We make 215,000 lbs. of soap. We also buy 360,000 lbs. of soap.	- - - -	Yes, by a contractor.	600*l.* for rent of a small shed and all the soapsuds.	The whole of the washings.	Very nearly clear.
None.	- - -	Yes. Gallipoli, in value 3 to 400*l.*	30,000 lbs.; sold to wool manufacturers.	Scour yarns. Soap 7,000 lbs., in value 130*l.*	62,600,000 gallons; spring water.	Yes, by a contractor.	30*l.*	The whole	Nearly clear.

Queries relating to the Woollen and

No.	Name of Manufacturer.	Residence.	1. What Weight of Wool do you use per Annum?	2. How much of this Wool do you wash per Annum?	3. Do you use Soap or Alkali as well as Urine in washing the Wool? If so, how much per Annum?	4. How much Water per Annum is used in washing?	5. Weight of Wool, and of what Colours dyed, per Annum?								
							Weight in lbs.	Blue.	Black.	Brown.	Crimson.	Drab.	Green.	Red.	Scarlet.	Yellow.
23	Wormald, John	Dewsbury	About 3,600,000 lbs.	None before manufacture.	Soap, alkali, urine, and pig's dung.	- - - -	About 240,000 lbs.	+	—	+	+	+	—	—	+	—
24	Yewdall, David, and Sons.	Leeds -	1,500,000 lbs.	All.	Alkali, 28,000 lbs.; urine for washing wool, 120,000 gallons; urine for scouring cloth, 108,000 gallons.	100,000,000 gallons.	96,000 lbs.	—	+	—	+	+	—	—	—	+
25	Not signed, postmark Bradford.	- - -	1,440,000 lbs.	All.	Soft soap, 168,000 lbs.	2,817,000 gallons.	- - -	—	—	—	—	—	—	—	—	—
26	Not signed, postmark Halifax.	- - -	2,400,000 lbs.	All.	Soap and alkali only, 76,800 lbs.	1,535,000 gallons.	Do not dye	—	—	—	—	—	—	—	—	—
27	Not signed, postmarks Shepley and Huddersfield.	- - -	300,160 lbs.	All.	Very little soap. About 2,240 lbs. of alkali.	About 7,160,400 gallons for wool, and 3,080,200 gallons for pieces.	289,200 lbs.	+	+	+	+	+	+	+	+	+
28	Not signed, postmarks Honley and Huddersfield.	- - -	300,000 lbs. wool, mungo, &c.	240,000 lbs.	Urine - -	- - - -	300,000 lbs.	+	+	+	—	—	—	—	—	—
a 29	John Shaw and Sons.	Staniland, near Halifax.	4,440,000 lbs.	2,880,000 lbs.	All soap - -	109,550,000 gallons.	We do not dye wool.	—	—	—	—	—	—	—	—	—

Note.—The + in the above columns is placed opposite the names of the manufacturers and dyers to denote the colours they dye.

a. This return was only received on August 7th, 1867, too late for use in the body of the report.

WORSTED TRADES, &c.—*continued.*

6. What Value of Dyestuffs do you use per Annum?	7. What Quantity of Water do you use in the Dye Vats per Annum, and where does the Waste Water flow?	8. Do you put Oil to the Wool before working it? If so, what Oil, and about what Value per Annum?	9. What Weight of Waste Wool do you produce in carding per Annum, and what becomes of it?	10. Do you wash the Goods? If so, do you buy or make Soap? How much, and what Value per Annum?	11. What Quantity of Water do you use per Annum in washing the Goods, and what Water, River or other?	12. Are the Soapsuds made on your Works treated for Recovery of Grease? If so, by yourself or by a Contractor?	13. What do you gain by the Extraction of the Grease per Annum?	14. Are the whole Washings treated, or only the First Flow?	15. Does the Water from the Grease Process pass away clear, or how nearly so?
2,500*l.*	Cannot say. Waste flows into river.	Yes. Rape, Price's patent cloth, and olive. In value 8,000*l.*	About 336,000 lbs. called Kent muck, at one time used for hops now sold or put on land, and about 12,000 lbs. waste sold to low carpet makers.	Yes. Buy soap, about 112,000 lbs. In value 1,700*l.*	River water principally, sometimes waterworks company.	Yes, by Messrs. Teall, Le Paige, and Company.	130*l.*	The first flow.	—
150*l.*	Waste water into river Aire.	Yes. Gallipoli, olive. In value 3,500*l.*	64,000 lbs. per annum; sold to waste dealers.	Yes. Buy soap. In value 1,000*l.*	15,000,000 gallons from river Aire and waterworks company.	Yes, by a contractor.	75*l.*	The first flow and the finishing.	Very nearly.
- - -	- - -	Yes. In value 1,000*l.*	48,000 lbs. per annum; sold to clothiers.	Only wash wool. See No. 4.	Only wash wool. See No. 4.	Yes, by a contractor.	About 100*l.*	All - -	Clear.
None.	None.	Yes. Gallipoli. In value 800*l.*	Cannot tell quantity; all sold.	Don't wash goods. Buy soap. See answer to No. 3.	None - - -	Yes, by a contractor.	About 150*l.*	The second flow only.	Nearly so.
350*l.* to 400*l.*	374,400 gallons; waste pumped out to land.	Yes. Olive and patent. In value 4,000*l.*	896 lbs.; we sell it, or put it on to land.	Yes. Buy soap, 11,200 lbs. In value 200*l.*	3,080,200 gallons; from springs.	No - - -	Nil.	- - -	All pumped on to land.
400*l.*	Waste flows into beck.	Yes. Olive and patent. In value 650*l.*	Burnt chiefly -	Yes. Buy soap. In value 250*l.*	Spring water -	Yes, by a contractor.	20*l.*	First flow	Nearly clear.
22,000*l.*	15,650,000	Yes. Gallipoli and Price's patent oil. 4,000*l.*	336,000 lbs.; used on land, and also in Kent for hop growing.	Yes. Buy soap. In value 2,500*l.*	109,550,000 gallons; one-third from wells, and the remaining two-thirds from river.	Yes, by a contractor.	150*l.*	The whole	Quite clear.

APPENDIX No. VII.

Impounding Reservoirs.

The first consideration in any proposed impounding reservoir work should be as to the site of the bank, and how to deal with it. If the site is rock, limestone, millstone grit, or other open-jointed rock, care must be taken so to combine the material of the bank with the rock as to prevent "creeping" and washing of water from within the reservoir along the junction of the puddle and rock at the bottom and sides of the bank, as also through the beds and joints of the strata. The cheapest material which can be safely used will be concrete, made of the best hydraulic lime, and laid thickly over the entire surface of the puddle-trench. Concrete, or a thick bed of mortar, should in fact protect puddle from contact with rock, gravel, clay, or earth at every point. A trench (answering as puddle-trench), filled with concrete, may in some instances be necessary if the ground contains landsprings, or produces much water during its excavation. If a trench fills rapidly with water when open, it may admit water to act upon any clay-puddle when the work has been completed, and just in proportion as this admission of water takes place under pressure, and washing or wasting of clay-puddle takes place, will there be danger to the embankment. On the other hand, concrete which has set will neither be injured nor injuriously wasted by washing, but any melting out of portions of lime will tend to fill up the pores and channels in the rock along which lime-impregnated water finds escape. An embankment having its base and sides fully protected by concrete and good rough hydraulic mortar, might leak considerably through fissures extending below the embankment, and yet not leak dangerously, as there could not be any washing and wasting of the material forming such bank.

No embankment should ever depend solely on a "clay puddle-wall." Puddle-walls should be supported throughout the main body of the bank on both sides, by selected material, such as earth freed from stones, loam, shale, or clay, and in this state capable of resisting water. Such selected material, combined with the puddle, should form the central portion of the bank, and be in substance not less than one-third of the entire bank. It will, however, be far better and safer to select material for the entire bank, and place it in thin layers (not exceeding 12 inches in depth,) evenly over the entire surface of the bank, using neither railways nor waggons, but wheelbarrows and "dobbin-carts."

The "Bunds" or banks of the great "Tanks" or reservoirs in India, have no puddle-trench such as modern engineers excavate (120 feet in depth at times). These Indian embankments were most probably formed on the surface after precautions had been taken to prevent creeps of water betwixt the materials used and the ground. The earth to constitute the bank was then carried to the site by numerous labourers, male and female, and was trodden down by thousands of naked human feet, sometimes also by the feet of elephants, and so was alternately washed by monsoon rains, dried by a tropical sun, and thus grew slowly, through years of labour, to be the enduring mass which has weathered the storms and tempests of not less than 30 centuries. Embankments have from time to time been ruptured and washed away in India in consequence of bye-wash space being limited, but other great Indian embankments have stood, and are now standing, to attest the skill, patience, and labour with which they were first formed. Many of the reservoir embankments in England recently formed have been made too rapidly. The hot speed of railway works cannot be safely adopted in waterworks. There must be time for incorporation of material with material, and for slow consolidation.

Reservoir embankments ought to be executed with more care, and will then necessarily be proportionately more costly than ordinary railway embankment works. Cheap work and speed have, however, been cried out for, and engineers have committed the fatal mistake of allowing the lowest contractor to have the job. The inevitable results are either that the contractor fails before the work is far advanced; or, if allowed to complete the bank, that the work, on being tested by filling the reservoir, proves worthless. A sound, safe, and enduring reservoir embankment cannot have been constructed at much less than double the price paid for earthwork which safely serves for railway embankments.

Reservoir embankments should never have outlet-works (pipes, culverts, or sluices) placed beneath or in the bottom mass of the made bank, but such works should be formed in the solid ground, on one side, so as to be beyond the influence of any subsidence or motion caused by piling up the materials forming the bank. Clay and marl subsoils will compress, subside, and occasionally slip, in which cases any pipes or culverts if placed in such bank are damaged, if not broken and utterly ruined.

Outlet-culverts need not be laid with their inverts at the bottom level of the reservoir, but may be from 10 to 20 feet above the inner bottom level of the bank. This mode of working insures that the base of the bank shall be undisturbed. In the Dale dyke reservoir which gave way above Sheffield, and destroyed some 235 human lives, cast-iron pipes were laid beneath the mass of the bank, at its lowest depth, the same pipes having the fall or grade of the valley, which amounted to near 20 feet in the 500 feet width of the bank; thus adding 20 feet additional pressure on the valves, which were placed on the outer foot of the bank. If a level culvert had been formed in the solid rock on one side, having its invert 20 feet above the bottom of the reservoir on the inner sides, and the valves had been placed in such culvert, there would have been 40 feet less head, and consequently 40 feet less pressure on the deepest working valve. The inner 20 feet in depth of water in a V-shaped valley, having a rise of 70 feet in the mile, is of little consequence, and the space forms a receptacle for sediment. But even this volume of water can be provided for, so as to be drawn down by a syphon laid through the outlet culvert, that the last foot in depth of water may be abstracted.

Some large embankments have failed so as to prevent their use, and the money expended upon their construction has been wasted. A reservoir embankment may fail from several causes, as—

1. Where an improper site has been chosen, upon rock full of natural fissures which cannot be traced and stopped.
2. Where the subsoil is compressible, as on silt, clay, or marl, and where outlet works have been placed in the made portion of such bank, and subsidence, crushing, and slipping have taken place.
3. Where a puddle-trench is affected by springs which have not been drained; or where washing and wasting of the clay-puddle commences through some undiscovered fissure, in rock or vein of gravel or sand, if in alluvium, after the head of pressure brought to bear from a full reservoir has been established.
4. Where the material of which the embankment is composed is not calculated to become water-tight, as rocky material or gravely earth tipped in from railway waggons an ordinary puddle-wall cannot be trusted under such arrangements; water under pressure finding its way to a puddle-wall so supported will have all its weakest points sought out and tested, and a leak once set up in such case must be a source of danger.
5. Where an embankment is made entirely of clay, which melts and slips as such material is liable to do if put together during wet weather.

A reservoir may also fail by a creep of water taking place through the embankment along the outer surface of either cast-iron pipes or outlet-culvert, or by drawing water from valves placed

under too great pressure within the embankment. Water issues through valves with friction and velocity proportionate to the head; it obeys the law of gravity applicable to the falling of solid bodies. A solid body of cast-iron falling through 90 feet of space would only strike with a similar velocity to that with which water would rush through an open valve at this depth, and as the power of water to wear, wash, and injure is in proportion to its volume and velocity, the engineer should, in his reservoir arrangements, use all practicable means to control and prevent high velocities through valves, discharge-culverts, and over bye-washes. No outlet valve ought to be placed under a greater head of pressure than 20 feet. Vertical wells for overflow are not advisable even when constructed in solid ground, but if formed within the substance of embankments they are positively dangerous. A bye-wash should be formed down the solid ground, and by steps not exceeding 4 feet in depth. The usual slopes given to reservoir embankments formed of earth are, on the inside 3 horizontal to 1 vertical, and on the outside $2\frac{1}{2}$ horizontal to 1 vertical. Minor details of construction and general rules for maintenance and working of impounding reservoirs cannot be fully given here, they will require to be treated separately in some special waterworks report. R. R.

Note.—In a valve-well there may be valves not more than 10 feet apart vertically, so as to reduce the pressure on any single valve to 10 feet, as the water is reduced.

APPENDIX No. VIII.

From the Times Newspaper of August 1, 1867.

Court of Chancery, Lincoln's Inn, July 31.

(Before the Lords Justices of Appeal.

Baxendale *v.* M'Murray.

This case has been already noticed in the *Times*. It will be remembered that it came on by way of an appeal from an injunction granted by Vice-Chancellor Stuart in July 1866, upon a motion for decree, restraining the defendant, Mr. M'Murray, from polluting the river Chess, near Rickmansworth, by the refuse from his paper mills. The operation of this decree was afterwards suspended by the Lords Justices pending the appeal. The plaintiff, Mr. Baxendale, is the occupier of Scotsbridge House, through the grounds of which the river Chess flows, this house and grounds being situate lower down the stream than Mr. M'Murray's mills. The mills were formerly occupied by the late Mr. Ingram. The plaintiff alleged great nuisance resulting to him in various ways from the refuse which flowed from the mills into the river, and in particular he said that whatever right to foul the stream had been acquired by the former owners of the paper mills, inasmuch as Mr. M'Murray had introduced into the manufacture of his paper the new material called Esparto grass, the fouling of the water thereby produced was a new kind of nuisance, with respect to which no prescriptive right had been acquired. The defendant maintained that he had a right to foul the stream in that way, provided he did so to no greater extent than his predecessors had done, and this he said that he had not done. The evidence was, as usual in cases of this kind, very conflicting. The appeal was argued at great length before Lord Cairns and the late Lord Justice Turner, and judgment was reserved, but was not delivered before the death of the latter. As the parties entertained some doubt whether, under the new Act, one Lord Justice could hear an appeal from a decree, even though made upon motion the appeal was placed on the paper to-day before both their Lordships for the purpose of being formally re-opened, and having the judgment of the Court.

Lord Justice Lord Cairns then stated, with a view to other cases of the same kind, that he had conferred both with his learned brother and the Lord Chancellor, and that they were all of opinion that under the new Act one Lord Justice had jurisdiction to hear appeals from decrees made upon motion for decree.

The appeal was then formally re-opened.

Mr. Bacon, Sir R. Palmer, and Mr. Fry appeared for the defendant; Mr. Dickinson and Mr. Birley for the plaintiff.

Lord Justice Lord Cairns then delivered the judgment of the Court. He said that the conclusion at which he had arrived was concurred in by the late Lord Justice. After a statement of facts of the case, his lordship proceeded thus,—Does the use of a new raw material in the manufacture of paper, from the mere circumstance that the material is raw and different from that formerly used, destroy the right previously possessed by the defendant to discharge polluted water into the stream? With great respect for his honour the vice-chancellor, I doubt whether the question on this part of the case is one as much of law as of fact. The question appears to me to be, what is the right or easement of the defendant? Is it a right, specific and defined, to pollute the stream by discharging the dirty water in which rags have been washed; or is it a right to discharge into the river the refuse liquor and foul washings produced by the manufacure at his mills of paper, in the reasonable and proper course of such manufacture, using the materials which are proper for the purpose, but not increasing, as against the servient tenement, to any substantial or tangible degree, the amount of pollution? In my opinion the right of the defendant would, upon the facts before us, be found, and be properly found, by a jury to be the latter and not the former. It is difficult to suppose the existence of an easement founded on and limited to the washing of rags. If made specific in this way, it would be confined to rags known and in use at the time the easement was acquired, and the rags of textile fabrics afterwards coming into use must, however valuable for the manufacture of paper, be excluded. Rags, again, would afford no standard by which to test or limit the amount of pollution. Some would be much more dirty than others; the washings from some might be harmless, and from others deleterious. In rags produced from vegetable substances the properties of the fibrous matter might be very different; in some, as in linen and cotton rags, the fibre being elaborately treated in the course of manufacture; in others, as in coarse sacking or bagging, especially of hemp or jute, the fibre retaining much more of its original character. I am therefore of opinion that it is not sufficient for the plaintiff to show that the defendant uses in the manufacture of paper a raw material different from that formerly employed; he must show, further, a greater amount of pollution and injury arising from the use of this new material; and the onus, of course, of showing this lies on the plaintiff. His lordship then commented at considerable length on the various heads of nuisance alleged by the plaintiff, and the evidence relating to them, and came to the conclusion that the plaintiff had failed to make out his case. The bill must therefore be dismissed with costs.

APPENDIX No. IX.

TOWNS, and PLACES, situate in the Basin of the Rivers AIRE and CALDER, divided into proposed CONSERVANCY DISTRICTS, with the AREAS and POPULATION, from 1801 to 1861, compiled from Census Tables.

Proposed Conservancy District.	City, Town, Borough, Township, Hamlet, or Place.	Area in Statute Acres.	POPULATION.						
			1801.	1811.	1821.	1831.	1841.	1851.	1861.
SKIPTON	Malham		262	306	262	259	233	188	184
	Kirkby-Malham		167	175	204	219	195	139	128
	Scosthrop		90	80	102	95	48	75	64
	Hanlith		81	51	46	42	25	36	40
	Malham Moor		98	97	88	94	102	92	115
	Airton		139	176	187	179	217	225	236
	Otterburn		26	47	40	66	48	54	59
	Calton		98	89	76	79	79	75	56
	Flasby-with-Winterburn		120	150	134	143	140	124	113
	Cracoe		191	162	179	150	153	159	139
	Hetton-with-Boardley		172	212	180	176	191	187	124
	Rilston		177	192	145	115	121	123	107
	Eshton		84	63	69	82	74	84	81
	Cold-Conistone		343	257	345	336	242	289	265
	Gargrave		728	897	972	1,062	1,176	1,214	1,103
	Embsay-with-Eastby		623	692	861	891	962	948	1,028
	Skipton		2,305	2,868	3,411	4,181	4,842	5,044	5,454
	Stirton-with-Thorlby		134	149	168	170	132	182	127
	Bank-Newton		68	102	139	125	129	120	106
	Coates		45	108	97	88	101	138	122
	Marton		322	348	382	443	381	341	256
	Broughton-with-Elslack		380	581	427	407	407	335	386
	Carlton		845	1,002	1,218	1,265	1,242	1,333	1,506
	Thornton-in-Craven		1,202	1,546	1,829	2,246	2,354	2,202	2,112
	Salterforth		398	502	686	725	675	573	424
	TOTAL of the DISTRICT carried to Summary, p. lxxiv.	64,320	9,098	10,852	12,247	13,638	14,269	14,280	14,335
KEIGHLEY	Bradleys-Both		385	412	506	614	557	571	442
	Silsden		1,323	1,608	1,904	2,137	2,346	2,508	2,582
	Cononley		876	1,045	1,350	1,567	1,159	1,272	905
	Farnhill		..	..	..	..	459	581	464
	Kildwick		209	216	175	190	189	206	170
	Glusburn		533	654	787	987	1,052	1,320	1,475
	Cowling		1,140	1,449	1,870	2,249	2,458	2,305	1,815
	Sutton		809	953	1,092	1,153	1,292	1,660	1,699
	Steeton-with-Eastburn		510	545	753	859	963	1,289	1,341
	Keighley		5,745	6,864	9,223	11,176	13,413	18,259	18,819
	Morton		838	987	1,199	1,219	1,693	1,902	2,113
	Bingley		4,100	4,782	6,176	8,036	10,157	13,437	13,254
	Haworth		3,164	3,971	4,668	5,835	6,303	6,848	5,896
	Wilsden		913	1,121	1,711	2,252	2,684	3,454	2,888
	TOTAL of the DISTRICT carried to Summary, p. lxxiv.	60,480	20,545	24,607	31,414	38,274	44,725	55,612	53,863
BRADFORD	Thornton		2,474	3,016	4,100	5,968	6,788	8,051	7,627
	Allerton		809	1,093	1,488	1,733	1,914	2,041	2,014
	Clayton		2,040	2,469	3,609	4,469	4,347	5,052	5,655
	Shipley		1,008	1,214	1,606	1,926	2,413	3,272	7,100
	Heaton		951	1,088	1,217	1,452	1,573	1,637	1,673
	Horton		3,459	4,423	7,192	10,782	17,615	28,143	30,189
	Manningham		1,357	1,596	2,474	3,564	5,622	9,604	12,889
	Bradford		6,393	7,767	13,064	23,223	34,560	52,493	48,646
	Bowling		2,055	2,226	3,579	5,958	8,918	13,538	14,494
	Idle		3,398	3,882	4,666	5,416	6,212	7,118	9,155
	Baildon		1,719	2,073	2,679	3,044	3,280	3,008	3,895
	Esholt		268	582	355	404	443	397	369
	Hawksworth		227		323	327	339	295	237
	Guiseley		825	959	1,213	1,604	1,971	2,572	2,566
	Yeadon		1,695	1,954	2,455	2,761	3,379	4,109	4,259
	Calverley-with-Farsley		2,081	2,390	2,605	2,637	4,142	4,892	5,559
	Eccleshill		1,351	1,608	2,176	2,570	3,008	3,700	4,482
	Bolton		474	581	634	671	683	874	937
	TOTAL of the DISTRICT carried to Summary, p. lxxiv.	33,600	32,584	38,921	55,435	78,509	107,207	150,796	161,746

Proposed Conservancy District.	City, Town, Borough, Township, Hamlet, or Place.	Area in Statute Acres.	POPULATION.						
			1801.	1811.	1821.	1831.	1841.	1851.	1861.
LEEDS -	Addle - - -		606	652	699	703	883	682	801
	Headingley-with-Burley -		1,313	1,670	2,154	3,849	4,768	6,105	9,674
	Bramley - - -		2,562	3,484	4,921	7,039	8,875	8,949	8,690
	Armley - - -		2,695	2,941	4,273	5,159	5,676	6,190	6,734
	Pudsey - - -		4,422	4,697	6,229	7,460	10,002	11,603	12,912
	Tong - - - -		1,336	1,505	1,893	2,067	2,515	2,797	3,035
	Drighlington - -		1,232	1,365	1,719	1,676	2,046	2,740	4,274
	Gildersome - - -		1,232	1,409	1,592	1,652	1,917	2,126	2,701
	Morley - - -		2,108	2,457	3,031	3,819	4,087	4,821	6,840
	Churwell - - -		502	666	814	1,023	1,198	1,103	1,564
	Beeston - - -		1,427	1,538	1,670	2,128	2,175	1,973	2,547
	Wortley - - -		1,995	2,336	3,179	5,944	7,090	7,896	12,058
	Holbeck - - -		4,196	5,124	7,151	11,210	13,346	14,152	15,824
	Leeds - - -		30,669	35,951	48,603	71,602	88,741	101,343	117,566
	Hunslet - - -		5,799	6,393	8,171	12,074	15,852	19,466	25,763
	Chapel-Allerton - -		1,054	1,362	1,678	1,934	2,580	2,842	3,083
	Potter-Newton - -		509	571	664	863	1,241	1,385	1,878
	Roundhay - - -		84	130	186	314	439	510	570
	Seacroft - - -		659	762	886	918	1,020	1,093	1,235
	Austhorpe - - -		103	150	150	169	173	219	231
	Thorpe Stapleton - -		5	5	25	19	15	36	44
	Templenewsam - -		1,033	976	1,166	1,458	1,428	1,693	1,806
	Swillington - - -		491	492	510	523	565	607	662
	Allerton-by-Water - -		331	292	329	375	490	550	704
	Middleton - - -		831	906	1,096	976	1,077	977	902
	Oulton-with-Woodlesford -		1,223	1,267	1,526	1,496	1,789	1,771	1,851
	Rothwell - - -		1,689	1,711	2,155	2,638	2,988	3,052	3,220
	Lofthouse-with-Carlton -		978	1,054	1,396	1,463	1,536	1,658	2,028
	Thorpe - - -		55	66	80	62	72	83	71
	TOTAL of the DISTRICT carried to Summary, p. lxxiv.	60,800	71,139	81,932	107,946	150,613	184,584	208,422	249,258

RIVER CALDER.

TODMORDEN -	Todmorden and Walsden -		2,515	3,652	4,985	6,054	7,311	7,699	9,146
	Stansfield - - -		4,768	5,447	7,275	8,262	8,466	7,627	8,174
	Langfield - - -		1,170	1,515	2,069	2,514	3,284	3,729	4,391
	Heptonstall - - -		2,983	3,647	4,543	4,661	4,791	4,177	3,497
	Erringden - - -		1,313	1,586	1,471	1,933	2,221	2,004	1,764
	Wadsworth - - -		2,801	3,473	4,509	5,198	5,583	4,491	4,141
	Midgley - - -		1,209	2,107	2,207	2,409	2,667	2,393	2,842
	TOTAL of the DISTRICT carried to Summary, p. lxxiv.	43,200	16,759	21,427	27,059	31,031	34,323	32,120	33,955
HALIFAX -	Warley - - -		3,546	3,958	4,982	5,685	6,857	6,408	6,482
	Sowerby - - -		4,275	5,177	6,890	6,457	8,163	7,908	8,753
	Norland - - -		1,181	1,316	1,665	1,618	1,670	1,706	1,718
	Ovenden - - -		4,513	4,752	6,360	8,871	11,799	12,738	11,037
	Halifax - - -		8,886	9,159	12,628	15,382	19,881	25,161	28,990
	Skircoat - - -		2,338	2,823	3,323	4,060	5,237	6,940	7,447
	Northowram - - -		4,887	5,306	6,841	10,184	13,352	15,285	16,178
	Shelf - - -		1,306	1,553	1,998	2,614	3,050	3,414	3,062
	Stainland-with-Old Lindley -		1,800	2,077	2,814	3,037	3,759	4,173	4,657
	Elland-with-Greetland -		3,385	3,963	5,088	5,500	6,479	7,225	8,716
	Barkisland - - -		1,799	2,076	2,224	2,292	2,391	2,129	2,003
	Rishworth - - -		960	1,211	1,588	1,536	1,710	1,540	1,244
	Soyland - - -		1,888	2,519	3,242	3,589	3,603	3,422	3,373
	Southowram - - -		3,148	3,615	4,256	5,751	6,478	7,380	7,245
	Hipperholme-cum-Brighouse -		2,879	3,357	3,936	4,977	5,421	6,091	7,340
	TOTAL of the DISTRICT carried to Summary, p. lxxiv.	52,160	46,791	52,862	67,835	81,553	99,850	111,520	118,275

Proposed Conservancy District.	City, Town, Borough, Township, Hamlet, or Place.	Area in Statute Acres.	POPULATION.						
			1801.	1811.	1821.	1831.	1841.	1851.	1861.
HUDDERSFIELD	Fixby		346	336	345	348	399	399	388
	Rastrick		2,053	2,442	2,796	3,021	3,482	3,917	4,516
	Lindley-cum-Quarmby		1,377	1,686	2,040	2,306	2,881	3,584	4,259
	Kirkheaton and Whitley		1,469	1,334	2,950	3,640	4,149	4,070	3,958
	Huddersfield		7,268	9,671	13,284	19,035	25,068	30,880	34,877
	Lockwood and Crosland Hill		1,253	1,490	1,881	3,134	4,303	5,556	6,755
	Golcar		1,846	2,122	2,606	3,143	3,598	4,212	5,110
	Longwood		1,276	1,461	1,942	2,111	2,418	3,023	3,402
	Linthwaite		1,381	1,643	2,127	2,852	3,310	3,802	4,300
	Scammonden		626	647	855	912	972	1,067	1,012
	Almondbury		3,751	4,613	5,679	7,086	8,828	9,749	10,361
	Farnley-Tyas		730	757	900	849	844	843	702
	Slaithwaite		2,007	2,277	2,871	2,892	2,925	2,852	2,932
	Marsden		1,958	1,845	2,330	2,340	2,403	2,665	2,689
	Kirkburton		1,405	1,693	2,153	2,650	3,474	3,560	3,664
	Thurstonland		783	868	989	1,098	1,286	1,320	1,116
	Meltham		1,278	1,430	2,000	2,746	3,263	3,758	4,046
	South-Crosland		1,221	1,424	1,583	2,258	2,705	2,784	2,794
	Lingards or Lingarths		642	712	809	758	801	811	783
	Honley		2,529	2,818	3,501	4,523	5,383	5,595	4,626
	Netherthong		679	787	927	1,004	1,156	1,207	1,097
	Upperthong		1,033	1,015	1,437	1,648	2,258	2,463	2,690
	Austonley		674	814	968	1,420	1,940	2,234	1,901
	Holmfirth		302	347	459	630	713	849	2,466
	Cartworth		997	1,121	1,211	1,796	2,247	2,538	2,503
	Wooldale		2,620	3,083	3,445	3,993	4,806	5,600	5,322
	Hepworth		804	828	1,048	1,229	1,436	1,532	1,530
	Fulstone		1,128	1,139	1,264	1,573	1,856	2,257	2,414
	Shepley		619	793	1,000	893	1,088	1,200	1,432
	Shelley		416	1,057	1,329	1,319	1,772	1,880	1,901
	Lepton		2,180	2,585	2,729	3,320	3,875	3,592	3,273
	Dalton		1,222	1,625	2,289	3,060	3,906	4,310	4,692
	TOTAL of the DISTRICT carried to Summary, p. lxxiv.	65,280	47,873	56,463	71,747	89,587	109,545	124,109	133,511
DEWSBURY	Bierley		3,820	4,766	6,070	7,254	9,512	11,710	12,500
	Gomersal		4,303	5,002	5,952	6,189	8,030	9,926	11,230
	Heckmondwike		1,742	2,324	2,579	2,793	3,537	4,540	8,680
	Liversedge		2,837	3,643	4,259	5,265	5,988	6,974	8,176
	Batley		2,574	2,975	3,717	4,841	7,076	9,308	14,173
	Soothill		2,134	2,609	3,099	3,849	4,453	5,059	6,238
	Dewsbury		4,566	5,059	6,380	8,272	10,600	14,049	18,148
	Mirfield		3,724	4,315	5,041	6,496	6,919	6,966	9,263
	Lower-Whitley		819	746	903	1,012	1,125	1,068	1,042
	Thornhill		1,499	1,619	1,932	2,371	2,816	2,791	3,479
	Horbury		2,101	2,356	2,475	2,400	2,683	2,803	3,246
	Hartshead and Clifton		1,628	1,728	2,007	2,408	2,675	2,729	2,652
	TOTAL of the DISTRICT carried to Summary, p. lxxiv.	30,080	31,747	37,142	44,414	53,150	65,414	77,923	98,827
WAKEFIELD	West-Ardsley		1,032	1,332	1,515	1,450	1,420	1,429	1,646
	East-Ardsley		686	812	832	853	900	838	1,069
	Ossett-with-Gawthorpe		3,424	4,083	4,775	5,325	6,078	6,266	7,950
	Wakefield		8,131	8,593	10,764	12,232	14,754	16,989	17,611
	Stanley-with-Wrenthorpe		3,260	3,769	4,620	5,047	6,625	7,257	8,237
	Methley		1,234	1,385	1,499	1,593	1,702	1,926	2,472
	Ackton		86	85	72	51	76	82	67
	Featherstone		305	320	337	328	318	347	353
	Normanton		276	269	250	283	481	495	563
	Altofts		334	408	404	502	704	603	1,210
	Carried forward		18,768	21,056	25,068	27,664	33,058	36,232	41,178

Proposed Conservancy District.	City, Town, Borough, Township, Hamlet, or Place.	Area in Statute Acres.	POPULATION.						
			1801.	1811.	1821.	1831.	1841.	1851.	1861.
	Brought forward - -		18,768	21,056	25,068	27,664	33,058	36,232	41,178
WAKEFIELD—*continued.*	Newland - - -		..	42	46	46	45	52	78
	Sharleston - - -		179	174	330	243	221	164	262
	Warmfield - - -		625	639	741	752	829	805	1,045
	Crofton - - -		535	424	459	361	389	363	402
	Snydale - - -		127	141	119	114	138	140	150
	Wintersett - - -		133	119	135	149	167	168	141
	Ryhill - - -		142	138	147	160	170	163	160
	Cold-Hiendley - -		180	162	189	153	141	112	109
	Walton - - -		315	311	385	376	510	473	471
	Sandal-Magna - -		765	789	888	1,075	1,278	1,536	1,590
	Crigglestone - - -		1,216	1,225	1,265	1,266	1,479	1,827	2,021
	Notton - - -		323	327	339	317	310	269	286
	Woolley - - -		565	543	482	553	418	450	531
	TOTAL of the DISTRICT carried to Summary, p. lxxiv.	43,520	23,873	26,090	30,593	33,229	39,153	42,754	48,424

RIVERS AIRE AND CALDER UNITED.

PONTEFRACT	Garforth - - -		234	610	731	782	1,195	1,335	1,504
	Kippax - - -		779	860	958	1,128	1,214	1,325	1,656
	Ledstone - - -		238	195	243	243	259	212	229
	Fairburn - - -		339	351	426	465	523	482	458
	Ledsham - - -		220	241	212	236	340	402	459
	Glass-Houghton - -		382	409	412	446	436	431	489
	Castleford - - -		793	890	1,022	1,141	1,414	2,150	3,876
	Pontefract - - -		3,097	3,605	4,447	4,832	4,669	5,106	5,346
	Tanshelf - - -		378	371	356	423	502	601	776
	Monkhill - - -		..	..	40	39	48	62	66
	Pontefract Park - -		47	50	47	51	96	84	74
	Ferry-Frytone - -		705	768	777	833	951	908	904
	Monk-Frystone - -		277	319	409	430	429	474	560
	Hillam - - -		190	258	269	291	342	340	319
	Burton-Salmon - -		114	138	182	142	166	240	247
	Birkin - - - -		139	136	139	129	169	176	168
	Brotherton - - -		1,115	1,457	1,626	1,623	1,744	1,551	1,449
	Knottingley - - -		2,602	3,327	3,753	3,666	4,304	4,540	4,379
	Cridling Stubbs - -		83	94	96	118	159	139	154
	Kellington - - -		1,048	1,151	1,328	1,388	1,493	1,450	1,443
	West-Haddlesey - -		224	238	293	296	288	222	213
	Gateforth - - -		178	145	192	223	258	192	174
	Chapel-Haddlesey - -		152	165	199	196	216	230	210
	Hensall - - -		213	225	233	250	290	252	264
	Heck - - - -		194	215	228	236	265	252	278
	Temple-Hirst - -		119	121	141	135	114	112	104
	Hirst-Courtney -		132	152	145	117	134	137	126
	Gowdall - - -		218	227	243	260	237	229	223
	Snaith - - -		688	743	834	885	855	840	914
	Rawcliffe - - -		920	1,143	1,496	1,450	1,523	1,552	1,630
	Cowick - - -		709	656	905	928	882	919	849
	Carlton - - -		536	687	775	808	802	784	752
	Camblesforth - - -		190	231	257	260	321	335	322
	Newland - - -		179	219	269	282	305	353	301
	Armin - - -		391	451	570	567	593	561	557
	TOTAL of the DISTRICT carried to Summary, p. lxxiv.	54,720	17,823	20,848	24,253	25,299	27,536	28,978	31,473

SUMMARY.

No.	Proposed Conservancy District.	Area in Statute Acres.	POPULATION.						
			1801.	1811.	1821.	1831.	1841.	1851.	1861.
	RIVER AIRE.								
1	Skipton - - -	64,320	9,098	10,852	12,247	13,638	14,269	14,280	14,335
2	Keighley - - -	60,480	20,545	24,607	31,414	38,274	44,725	55,612	53,863
3	Bradford - - -	33,600	32,584	38,921	55,435	78,509	107,207	150,796	161,746
4	Leeds - - -	60,800	71,139	81,932	107,946	141,613	184,584	208,422	249,268
	Total in Basin of River Aire - - -	219,200	133,366	156,312	207,042	272,034	350,785	429,110	479,212
	RIVER CALDER.								
5	Todmorden - -	43,200	16,759	21,427	27,059	31,031	34,323	32,120	33,955
6	Halifax - - -	52,160	46,791	52,862	67,835	81,553	99,850	111,520	118,275
7	Huddersfield - -	65,280	47,873	56,463	71,747	89,587	109,545	124,109	133,511
8	Dewsbury - - -	30,080	31,747	37,142	44,414	53,150	65,414	77,923	98,827
9	Wakefield -	43,520	23,873	26,090	30,593	33,229	39,153	42,754	48,424
	Total in Basin of River Calder - -	234,240	167,043	193,984	241,648	288,550	348,285	388,426	432,992
	RIVERS AIRE AND CALDER UNITED.								
10	Pontefract - -	54,720	17,823	20,848	24,253	25,299	27,536	28,978	31,473
	Total in entire Basin of the Rivers Aire and Calder - - -	508,160	318,232	371,144	472,943	585,883	726,606	846,514	943,677

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54

54

WESTMORLAND

NORTH SEA

RICHMOND

Gilling

Marsk

R. Swale

Muker

Ellerton

Birkby

R. Wiske

Welbury

Osmotherly

Northallerton

Hawes

Askrigg

R. Ure

Leyburn

Middleham

Bedale

Kepwick

Otterington

Thirlby

Thirsk

R. Swale

Topcliffe

Bilsdale Kirkham

Hewnby

Lastingham

Levisham

Silpho

SCARBOROUGH

Kirkby Moorside

Helmsley

Pickering

Ayton

Buckden

Masham

Middlesmoor

R. Nidd

Laverton

RIPON

Easingwold

Stillington

Stittenham

NEW MALTON

R. Derwent

Teddingham

Brawby

R. Rye

Ryton

Flaxton

Malham Tarn

Malham Cove

Malham Scar

Hard Fusk

Kilnsey Crag

Burdley Pastiles

Hebden

Grimwith Reservoir

Pateley Bridge

Borough bridge

R. Ure

Linton

Ripley

Thureross

R. Washburn

Knaresborough

Harrogate

Bolton

Gargrave

Skipton

Ilkley

Farnley

R. Nidd

Cowthorp

YORK

Scrayingham

Haxby

Kexby

Pocklington

Beilby

Bubwith

Arncliffe

Cowling

Silsden Reservoir

R. Aire

Keighley

Bingley

Otley

R. Wharfe

Harewood

Wetherby

Tadcaster

Stillingfleet

Aberford

Cawood

Calverley

Reservoir

CONDUIT OF THE LEEDS W. WORKS

CONDUIT OF THE BRADFORD CORPORATION WATER WORKS

ORIGINAL CONDUIT

Burden Reservoir

Choker Reservoir

Fountain Fell

Black Hill

Great Scar

Malham Tarn

Malham Cove

Hard Fusk

Kilnsey Crag

Burdley Pastiles

Grimwith Reservoir

Burden Reservoir

Choker Reservoir

Silsden Reservoir

Reservoir

Nº 1.

SKETCH MAP

OF THE BASIN

OF

THE RIVER OUSE.

SCALE OF STATUTE MILES.

0 5 10

N.B.— The Basin of the Rivers Aire and Calder is colored Pink.

The figures are heights in Feet above Ordnance Datum.

Entire Area of the Basins of the River Ouse :—
4207 Square Miles, or 2,692,480 Statute Acres.

Area of Basin of River Aire	*342½*	*Sq. Miles, or*	*219200*	*Stat. Acres.*
Do Do Calder	*366*	*„*	*234240*	*„*
Do of united Aire & Calder	*85½*	*„*	*54720*	*„*
Total Area	*794*	*„*	*508160*	*„*

Stanford's Geographical Establishment, London.

Nº 2.

GEOLOGICAL MAP

of the

AIRE AND CALDER BASIN

reduced from

PROFESSOR PHILLIPS' GEOLOGY OF YORKSHIRE.

SCALE OF STATUTE MILES.

1 0 1 2 3 4 5 6 7

The figures are heights in feet above Ordnance Datum.

Explanation.

New Red Sandstone	f
Permian	e
Coal Measures	d 5
Millstone Grit	d 4
Yoredale Rocks	d 3
Limestone	d 2
Alluvium	

Stanford's Geographical Establishment, 1867

AREAS AND POPULATION OF
CONSERVANCY DISTRICTS.

	Sq. Miles.	Stat. Acres.	Population, 1861.
1. Skipton	100·5	64,320	14,335
2. Keighley	94·5	60,480	53,863
3. Bradford	52·5	33,600	161,746
4. Leeds	95·0	60,800	249,268
5. Todmorden	67·5	43,200	33,955
6. Halifax	81·5	52,160	118,275
7. Huddersfield	102·0	65,280	133,511
8. Dewsbury	47·0	30,080	98,827
9. Wakefield	68·0	43,520	48,424
10. Pontefract	85·5	54,720	31,473
Total	794·0	508,160	943,677

Nº 3.

SKETCH MAP

OF THE BASIN

of

THE AIRE AND CALDER

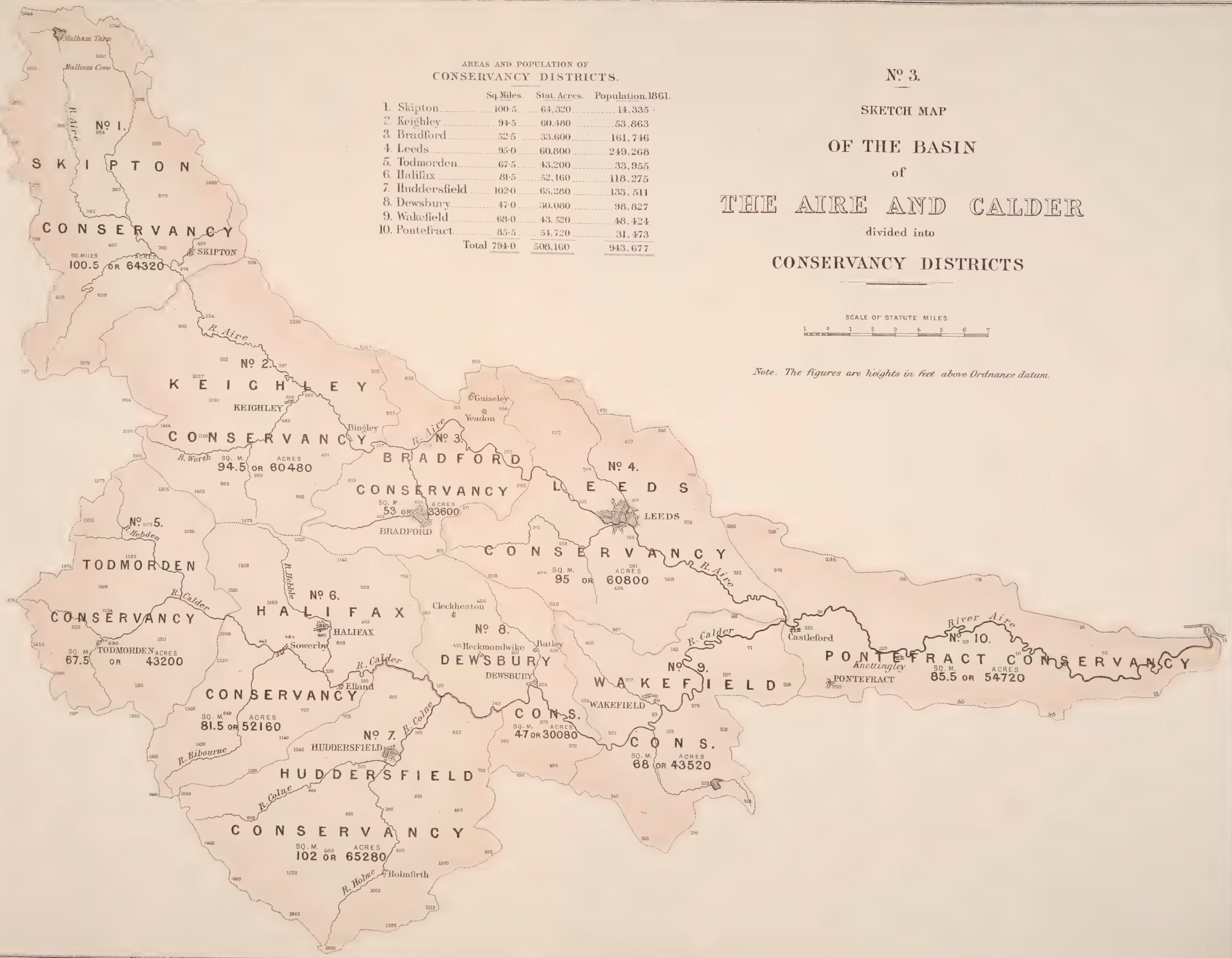
divided into

CONSERVANCY DISTRICTS

SCALE OF STATUTE MILES.

1 0 1 2 3 4 5 6 7

Note. The figures are heights in feet above Ordnance datum.



Stanford's Geographical Establishment, 1867.

Nº 4

SKETCH MAP
of
THE DRAINAGE AREA
of the
RIVER COLNE AND ITS TRIBUTARIES
(above its Junction with the River Calder)
having
HUDDERSFIELD
as the
PRINCIPAL TOWN IN THIS WATERSHED

Area about 102 Square Miles or 65280 Sta. Acres

SCALE 0 — 2 MILES

NOTE

The Centre of the River Calder to be the Boundary along this River

The Figures are heights in feet above ordnance Datum

Boundary of Proposed Conservancy District .....

HUDDERSFIELD PROPOSED CONSERVANCY DISTRICT

River Calder
Rastrick
Sheepridge
River Colne
Grimescar Dyke
Lindley
Lonc Clough
Longwood Brook
Longwood
Golcar
Kirkheaton
HUDDERSFIELD
Paddock
River Colne
Lockwood
Almondbury
Linthwaite
Slaithwaite
Farnley Tyas
S. Crosland
Mag Brook
Kirkburton
Honley
Reservoir
Thurstonland
Nether Thong
Sude Hill
Holmfirth
Holmbridge
Bilberry Reservoir
River Holme
Reservoir
Bowshaw Reservoir
Marsden
Red Brook Reservoir
Black Moss Reservoir
Blake Clough
Black Clough
Wessenden Reservoir
Rams Clough
Marsden Clough
Long Wham
Oakner Cl.
Long Clough
Reservoir
Boundary of Huddersfield Proposed Conservancy District
Boundary of Huddersfield Proposed Conservancy District

APPENDIX No. X.

STATISTICS of the TRADES and MANUFACTURES in the Basin of the Rivers AIRE and CALDER in the carrying on of which WATER is used and POLLUTED.

NAME OF TOWN.	Blanket Manufacturers.	Brewers.	Carpet Manufacturers.	Chemists, Manufacturing.	Corn Millers.	Dyers.				Finishers.	Fullers and Scribblers.	Glue Manufacturers.	Maltsters.	Paper and Paperhanging Manufacturers.	Linen Manufacturers.	Lead Manufacturers.	Short Wool, Shoddy, Waste, and Mungo Dealers.	Sizers.	Soap Manufacturers.	Grease Manufacturers.	Spinners and Manufacturers.					Stuff Manufacturers.	Tanners.	Woollen Manufacturers.	Woollen Card Manufacturers.	Wool Combers.	Ware Grinders.	Wool and Stuff Printers.	Wire Manufacturers.
						Woollen Cloth.	Wool and Yarn.	Stuff.	Silk and Cotton.												Worsted.	Cotton.	Flax.	Silk.	Woollen Yarn.							
RIVER AIRE.																															
SKIPTON Proposed Conservancy District.																															
Carlton	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
Connistone Cold	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Earby	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
Gargrave	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.
Kirkby Malham	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.
Skipton	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	3	.	.	.	.	1	.	.	.	.
Total carried to Summary, page 12	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	9	.	.	.	.	1	.	.	.	.
KEIGHLEY Proposed Conservancy District.																															
Bingley	.	.	.	.	3	.	.	.	.	.	.	.	6	.	.	.	.	.	.	.	27	.	.	.	.	3	.	.	.	.	.
Cowling	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	1	.	.	.	.	.	.	.	.	.
Cullingworth	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	2	.	.	.	.	.
Denholm	.	1	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Eastburn	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Glusburn	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.	.	.	.
Haworth	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	19	1	.	.	.	.	.	.	.	.	.
Keighley	.	3	.	.	5	.	.	2	.	.	.	.	.	3	.	.	.	.	.	.	35	.	.	.	.	.	.	.	.	4	.
Kildwick	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Morton	.	.	.	.	1	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	6	1	.	.	.	.	.	.	.	1	.
Steeton	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Sutton	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	3	.	.	.	.	.	.	.	.	.	.
Wilsden	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	12	.	.	.	.	.	.	.	.	.	.
Total carried to Summary, page 12	.	4	.	2	13	.	.	2	.	.	.	.	6	5	.	.	.	1	.	.	111	3	.	.	1	.	5	.	.	5	.	.	.

Statistics of the TRADES and MANUFACTURES in the Basin of the Rivers AIRE and CALDER in the carrying on of which WATER is used and POLLUTED—*continued.*

NAME OF TOWN.	Blanket Manufacturers.	Brewers.	Carpet Manufacturers.	Chemists, Manufacturing.	Corn Millers.	Dyers.				Finishers.	Fullers and Scribblers.	Glue Manufacturers.	Maltsters.	Paper and Paperhanging Manufacturers.	Linen Manufacturers.	Lead Manufacturers.	Short Wool, Shoddy, Waste, and Mungo Dealers.	Sizers.	Soap Manufacturers.	Grease Manufacturers.	Spinners and Manufacturers.					Stuff Manufacturers.	Tanners.	Woollen Manufacturers.	Woollen Card Manufacturers.	Wool Combers.	Ware Grinders.	Wool and Stuff Printers.	Wire Manufacturers.
						Woollen Cloth.	Wool and Yarn.	Stuff.	Silk and Cotton.												Worsted.	Cotton.	Flax.	Silk.	Woollen Yarn.							
BRADFORD Proposed Conservancy District.	RIVER AIRE—*continued.*																														
Allerton	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	20	.	.	.	.	.	.
Apperley Bridge	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Baildon	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	7	.	.	.	.	.	.
Bolton	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.
Bradford	.	11	.	10	4	.	.	29	.	6	.	.	7	.	.	.	123	7	.	3	129	10	.	.	.	94	3	.	.	39	.	.	.
Calverley	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1	.	.	.	.	.	.	.	28	.	.	.	.	.
Clayton	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cottingley	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1	.	.	1	.	.	.
Eccleshill	.	.	.	.	1	.	.	.	.	.	3	.	.	.	.	.	2	3	.	.	.	.	.	.	.	.	.	35	.	.	.	.	.
Farsley	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	3	3	.	.	.	.	.	.	.	.	.	30	.	.	.	.	.
Guiseley	.	.	.	.	.	.	.	.	.	.	4	.	3	.	.	.	1	.	.	.	.	.	.	.	.	.	.	98	.	.	.	.	.
Heaton	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.
Horsforth	.	.	.	.	2	.	.	1	1	.	.	.	.	1	.	.	1	1	.	1	1	1	.	1	.	.	3	30	.	.	.	.	.
Idle	.	.	.	.	1	.	.	.	.	.	.	.	4	.	.	.	.	3	.	.	.	.	.	.	.	.	.	59	.	.	.	.	.
Rodley	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Shipley	.	.	.	.	.	1	.	.	.	.	2	1	.	1	.	.	.	.	.	.	7	.	.	.	.	.	.	.	.	.	.	.	.
Stanningley	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	1	.	.	.	.	.	.	.	.	.	24	.	.	.	.	.
Thornton	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	.	.	.	.	.	.	.	.	1	.	.	.
Yeadon	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	104	.	.	.	.	.
Total carried to Summary, page 12	.	12	.	10	9	1	.	30	1	6	16	1	14	2	.	.	148	19	.	6	159	11	.	1	.	121	7	410	.	41	.	.	.

RIVER AIRE—*continued.*

Name of Town.	Blanket Manufacturers.	Brewers.	Carpet Manufacturers.	Chemists, Manufacturing.	Corn Millers.	Dyers. Woollen Cloth.	Dyers. Wool and Yarn.	Dyers. Stuff.	Dyers. Silk and Cotton.	Fitnishers.	Fullers and Scribblers.	Glue Manufacturers.	Maltsters.	Paper and Paperhanging Manufacturers.	Linen Manufacturers.	Lead Manufacturers.	Shoddy, Mungo and Waste Dealers.	Sizers.	Soap Manufacturers.	Grease Manufacturers.	Spinners and Manufacturers. Worsted.	Spinners and Manufacturers. Cotton.	Spinners and Manufacturers. Flax.	Spinners and Manufacturers. Silk.	Spinners and Manufacturers. Woollen Yarn.	Stuff Manufacturers.	Tanners.	Woollen Manufacturers.	Woollen Card Manufacturers.	Wool Combers.	Ware Grinders.	Wool and Stuff Printers.	Wire Manufacturers.
LEEDS Proposed Conservancy District.																																
Armley - - -	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	3	1	.	.	.	.	.	.	.	.	2	42	.	.	.	.
Beeston - - -	.	.	.	.	1	2	.	.	.	3	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	6	.	.	.	.
Bramley - - -	.	.	.	.	1	.	.	2	.	.	.	.	.	.	.	.	1	2	.	.	.	.	.	.	.	.	2	19	.	.	.	.
Chapel Allerton - -	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	2	.	.	.	.	.	1	1	.	.	.	.
Churwell - - -	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.
Drighlington - -	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
Gildersome - -	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	12	.	.	.	.
Kirkstall - - -	.	.	.	.	1	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1	3	.	.	.	.
Leeds - - -	.	13	10	29	21	24	9	10	19	46	11	3	36	21	17	.	63	2	7	.	8	.	25	1	9	.	28	150	.	6	.	.
Lofthouse and Carlton -	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Morley - - -	.	.	.	.	.	.	.	2	.	.	11	.	.	.	.	.	11	1	.	.	.	1	.	.	.	.	1	73	.	.	.	.
Oulton-cum-Woodlesford	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Pudsey - - -	.	.	.	.	1	.	.	.	.	.	14	1	.	.	.	.	21	5	.	2	.	.	.	.	.	.	3	137	.	.	.	.
Rothwell - - -	.	.	.	1	1	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1	.	.
Tong - - -	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.
Wortley - - -	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	23	.	.	.	.
Newlay - - -	.	.	.	.	.	.	.	2	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.
Total carried to Summary, page 12 -	.	13	10	31	28	27	9	16	19	52	36	7	45	22	17	.	108	14	7	2	15	1	26	1	9	.	41	470	1	8	.	.

STATISTICS of the TRADES and MANUFACTURES in the Basin of the Rivers AIRE and CALDER in the carrying on of which WATER is used and POLLUTED—*continued.*

NAME OF TOWN.	Blanket Manufacturers.	Brewers.	Carpet Manufacturers.	Chemists, Manufacturing.	Corn Millers.	Dyers. Woollen Cloth.	Dyers. Wool and Yarn.	Dyers. Stuff.	Dyers. Silk and Cotton.	Finishers.	Fullers and Scribblers.	Glue Manufacturers.	Maltsters.	Paper and Paperhanging Manufacturers.	Linen Manufacturers.	Lead Manufacturers.	Short Wool, Shoddy, Waste, and Mungo Dealers.	Sizers.	Soap Manufacturers.	Grease Manufacturers.	Spinners and Manufacturers. Worsted.	Spinners and Manufacturers. Cotton.	Spinners and Manufacturers. Flax.	Spinners and Manufacturers. Silk.	Spinners and Manufacturers. Woollen Yarn.	Stuff Manufacturers.	Tanners.	Woollen Manufacturers.	Woollen Card Manufacturers.	Wool Combers.	Ware Grinders.	Wool and Stuff Printers.	Wire Manufacturers.
RIVER CALDER.																																
TODMORDEN Proposed Conservancy District.																																
Hebden Bridge	.	.	.	.	2	.	.	.	4	6	.	.	.	.	.	.	6	.	.	.	.	26	.	.	.	.	.	.	.	.	.	
Heptonstall	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	2	.	.	.	.	.	.	.	.	.	
Midgley	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	
Mytholmroyd	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	
Todmorden	.	.	.	6	.	.	.	.	3	.	.	.	2	.	.	.	10	3	.	.	.	85	.	.	.	.	.	.	.	.	.	.	
Total carried to Summary, page 12	.	1	.	6	3	.	.	.	7	6	.	.	2	1	.	.	19	3	.	.	5	123	.	.	.	.	.	.	.	.	.	.	
HALIFAX Proposed Conservancy District.																																
Brighouse	.	.	.	.	2	2	.	.	.	.	1	.	4	.	.	.	1	.	1	.	10	15	.	7	3	.	1	5	.	.	.	1	7
Elland	.	.	.	1	1	3	.	.	.	.	.	.	.	1	.	.	3	.	.	.	4	10	.	.	.	.	.	61	7	.	.	.	.
Halifax	.	8	5	6	3	10	5	10	5	6	.	.	2	2	.	.	29	2	.	.	44	15	.	2	.	24	3	13	18	6	3	.	6
Luddenden	.	.	.	.	2	.	.	.	1	.	.	.	2	.	.	.	.	.	.	.	6	9	.	.	.	.	.	.	.	.	.	.	.
Northowram	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.
Ovenden	.	8	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	18	8	.	1	.	.	.	.	.	.	.	.	.
Ripponden	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
Shelf	.	.	.	1	1	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Skircoat	.	.	.	.	3	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1	4	.	.	.	3	.	.	.	.	.	.	.	.
Southowram	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	3	.	.	.	.
Sowerby Bridge	.	.	.	4	2	2	.	.	.	.	1	.	5	.	.	.	6	.	.	.	7	7	.	.	.	.	4	16	.	.	.	.	.
Stainland	.	1	.	1	.	.	.	.	.	.	.	.	.	2	.	.	3	.	.	.	2	.	.	.	.	.	.	14	.	.	.	.	.
Total carried to Summary, page 12	.	19	5	14	15	17	5	10	6	8	2	.	13	5	.	.	42	2	1	2	100	65	.	11	7	24	8	109	28	6	3	1	13

RIVER CALDER—*continued.*

Name of Town.	Blanket Manufacturers.	Brewers.	Carpet Manufacturers.	Chemists, Manufacturing.	Corn Millers.	Woollen Cloth.	Dyers. Wool and Yarn.	Dyers. Stuff.	Dyers. Silk and Cotton.	Finishers.	Fullers and Scribblers.	Glue Manufacturers.	Maltsters.	Paper and Paperhanging Manufacturers.	Linen Manufacturers.	Lead Manufacturers.	Shoddy, Mungo Dealers.	Soap Manufacturers.	Grease Manufacturers.	Spinners and Manufacturers. Worsted.	Spinners and Manufacturers. Cotton.	Spinners and Manufacturers. Flax.	Spinners and Manufacturers. Silk.	Spinners and Manufacturers. Woollen Yarn.	Stuff Manufacturers.	Tanners.	Woollen Manufacturers.	Woollen Card Manufacturers.	Wool Combers.	Ware Grinders.	Wool and Stuff Printers.	Wire Manufacturers.
Huddersfield Proposed Conservancy District.																															
Almondbury - -	.	2	.	.	.	2	.	.	.	.	.	.	.	.	.	.	4	1	.	.	.	.	.	.	.	.	21	.	.	.	.
Crosland (South) -	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	8	.	.	.	.
Deighton and Sheepridge -	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	.	.	.	.
Golcar - -	.	.	.	.	.	.	.	.	.	18	11	.	.	.	.	.	21	.	.	.	.	.	1	.	.	.	105	.	.	.	.
Holmfirth - -	.	.	.	.	.	2	.	.	.	3	10	.	.	.	.	.	4	2	.	.	.	.	.	.	.	.	30	.	.	.	.
Honley - -	.	1	.	.	1	5	.	.	.	4	4	.	.	.	.	.	.	1	.	.	.	.	.	2	.	.	21	.	.	.	.
Huddersfield - -	.	19	.	22	4	26	.	.	.	36	.	.	.	.	.	.	100	.	1	45	.	.	6	.	.	.	347	3	.	.	.
Kirkburton - -	.	.	.	.	2	1	.	.	.	.	2	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	7	.	.	.	.
Kirkheaton - -	.	1	.	1	.	.	.	.	.	1	2	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	9	.	.	.	.
Lindley - -	.	1	.	4	.	1	.	.	.	1	2	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	20	1	.	.	.
Linthwaite - -	.	3	.	.	1	2	.	.	.	2	1	.	.	.	.	.	2	.	.	.	.	.	.	.	.	1	19	1	.	.	.
Lockwood - -	.	.	.	3	.	.	2	.	.	14	.	.	.	.	.	.	2	.	.	.	.	.	2	1	.	.	15	.	.	.	.
Marsden - -	.	.	.	.	1	.	.	.	.	1	3	.	.	.	.	.	1	.	.	.	.	.	1	.	.	.	17	1	.	.	.
Meltham - -	.	.	.	.	.	1	.	.	.	.	2	.	.	.	.	.	.	.	.	.	2	.	1	1	.	.	6	.	.	.	.
Rastrick - -	.	2	1	1	.	1	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1	.	2	.	.	.	15	1	.	.	.
Shelley - -	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1	.	.	5	1	.	.	.
Shepley - -	.	1	.	.	1	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	26	.	.	.	.
Slaithwaite - -	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	26	.	.	.	.
Thurstonland - -	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Farnley Tyas - -	.	1	.	.	1	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Upper Thong - -	.	.	.	.	.	1	.	.	.	.	1	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	11	.	.	.	.
Total carried to Summary, page 12 - }	.	30	1	32	14	43	2	.	.	81	40	.	.	.	.	.	146	5	1	.	45	4	.	13	5	.	3	720	8	.	1	.
Dewsbury Proposed Conservancy District.																															
Batley - -	23	.	.	2	2	.	.	.	.	.	24	.	.	.	.	.	128	.	.	.	1	.	.	3	.	.	56	.	.	.	.
Bierley (North) -	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	12	.	.	.	.	.	3	.	2	.	.	1
Birkenshaw - -	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	3	.	.	.	.	.	.	4	.	.	.	.

Name of Town.	Blanket Manufacturers.	Brewers.	Carpet Manufacturers.	Chemists, Manufacturing.	Corn Millers.	Dyers. Woollen Cloth.	Dyers. Wool and Yarn.	Dyers. Stuff.	Dyers. Silk and Cotton.	Finishers.	Fullers and Scribblers.	Glue Manufacturers.	Maltsters.	Paper and Paperhanging Manufacturers.	Linen Manufacturers.	Lead Manufacturers.	Shoddy, Waste, and Mungo Dealers.	Sizers.	Soap Manufacturers.	Grease Manufacturers.	Spinners and Manufacturers. Worsted.	Spinners and Manufacturers. Cotton.	Spinners and Manufacturers. Flax.	Spinners and Manufacturers. Silk.	Spinners and Manufacturers. Woollen Yarn.	Stuff Manufacturers.	Tanners.	Woollen Manufacturers.	Woollen Card Manufacturers.	Wool Combers.	Ware Grinders.	Wool and Stuff Printers.	Wire Manufacturers.
Dewsbury—*cont.*																																
RIVER CALDER—*continued.*																																
Birstal	.	.	.	.	1	2	.	.	.	.	2	.	.	.	.	.	.	1	.	.	2	.	.	.	.	.	.	4	.	.	.	.
Cleckheaton	.	.	.	9	.	.	.	.	.	.	3	.	8	.	.	.	.	.	.	.	.	3	.	.	.	.	.	35	30	.	.	.	.
Dewsbury	26	.	6	.	3	5	.	.	2	.	13	.	.	.	.	.	61	3	.	.	.	.	.	.	9	.	3	56	4	.	.	.	.
Earlsheaton	49	.	.	.	1	1	.	.	.	.	7	.	4	.	.	.	9	.	.	1	.	.	.	.	.	.	.	16	.	.	.	.	.
Gomersal (Great & Little)	.	.	.	2	.	.	.	.	.	.	1	.	3	.	.	.	5	.	.	.	3	.	.	.	.	.	.	15	2	.	.	.	.
Hangingheaton	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	15	1	.	.	.	.	.	.	.	.	.	13	.	.	.	.	.
Hartshead	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	9
Heckmondwike	29	.	6	.	.	2	.	.	.	.	8	.	.	.	.	.	20	.	.	.	.	.	.	.	8	.	.	9	3	.	.	.	.
Liversedge	8	.	5	9	1	1	.	.	.	2	4	.	2	.	.	.	2	.	.	1	1	.	.	1	3	.	.	6	16	.	.	.	5
Mirfield	.	.	.	.	3	.	.	.	.	.	16	.	15	.	.	.	3	.	.	.	.	2	.	.	.	.	6	23	5	.	.	.	2
Thornhill	.	.	.	1	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1	.	.	.	.	.
Total carried to Summary, page 12	135	1	17	24	13	11	.	.	2	2	78	.	35	.	.	.	246	5	.	2	24	6	.	1	23	.	12	238	62	.	.	.	17
Wakefield Proposed Conservancy District.																																
Alverthorpe-with-Thornes	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	4	.	.	.	.	.	.	4	.	.	.	.
Horbury	.	.	.	.	1	3	.	.	.	.	6	.	1	1	.	.	11	.	.	.	7	.	.	1	.	.	1	13	.	.	.	.
Ossett-cum-Gawthorpe	4	.	.	.	.	1	.	.	.	1	11	.	.	.	.	.	69	.	.	1	5	.	.	.	.	.	.	83	.	.	.	.
Wakefield	.	5	2	4	9	7	.	.	.	.	.	.	32	.	.	.	.	.	2	1	4	.	.	.	10	.	5	2	.	.	.	.
Total carried to Summary, page 12	4	5	2	4	10	11	.	.	.	1	17	.	33	1	.	.	80	.	3	3	20	.	.	1	10	.	6	102	.	.	.	.	.
Pontefract Proposed Conservancy District.																																
RIVERS AIRE AND CALDER UNITED.																																
Castleford	.	.	.	1	.	1	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Knottingley	.	1	.	1	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pontefract	.	.	.	.	3	.	.	.	.	.	.	.	8	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.
Total carried to Summary, page 12	.	1	.	2	5	2	.	.	.	.	.	.	12	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.

SUMMARY.

Proposed Conservancy District.	Blanket Manufacturers.	Brewers.	Carpet Manufacturers.	Chemists, Manufacturing.	Corn Millers.	Dyers.				Finishers.	Fullers and Scribblers.	Glue Manufacturers.	Maltsters.	Paper and Paperhanging Manufacturers.	Linen Manufacturers.	Lead Manufacturers.	Short Wool, Shoddy, Waste, and Mungo Dealers.	Sizers.	Soap Manufacturers.	Grease Manufacturers.	Spinners and Manufacturers.					Stuff Manufacturers.	Tanners.	Woollen Manufacturers.	Woollen Card Manufacturers.	Wool Combers.	Ware Grinders.	Wool and Stuff Printers.	Wire Manufacturers.
						Woollen Cloth.	Wool and Yarn.	Stuff.	Silk and Cotton.												Worsted.	Cotton.	Flax.	Silk.	Woollen Yarn.							
RIVER AIRE.																																
Skipton	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	9	.	.	.	.	1	.	.	.	.	.
Keighley	.	4	.	2	13	.	.	2	.	.	.	.	6	5	.	.	.	1	.	.	111	3	.	.	1	.	5	.	.	5	.	.	.
Bradford	.	12	.	10	9	1	.	30	1	6	16	1	14	2	.	.	148	19	.	6	159	11	.	1	.	121	7	410	.	41	.	.	.
Leeds	.	13	10	31	29	27	9	16	19	52	36	7	45	22	17	.	108	14	7	2	27	1	26	1	9	.	42	471	1	.	8	.	1
Total in Basin of River Aire	.	29	10	43	52	28	9	48	20	58	52	8	65	29	17	1	256	34	7	8	297	24	26	2	10	121	55	881	1	46	8	.	1
RIVER CALDER.																																
Todmorden	.	1	.	6	3	.	.	.	7	6	.	.	2	1	.	.	19	3	.	.	5	123	.	.	.	.	.	.	.	.	.	.
Halifax	.	19	5	14	15	17	5	10	6	8	2	.	13	5	.	.	42	2	1	2	100	65	.	11	7	24	8	109	28	6	3	1	13
Huddersfield	.	30	1	32	14	43	2	.	.	81	40	.	.	.	.	.	146	5	1	.	45	4	.	13	5	.	3	720	8	.	.	1	.
Dewsbury	135	1	17	24	13	11	.	.	2	2	78	.	35	.	.	.	246	5	.	2	24	6	.	1	23	.	12	238	62	.	.	.	17
Wakefield	4	5	2	4	10	11	.	.	.	1	17	.	33	1	.	.	80	.	3	3	20	.	.	1	10	.	6	102	.	.	.	.	.
Total in Basin of River Calder	139	56	25	80	55	82	7	10	15	98	137	.	83	7	.	.	533	15	5	7	194	198	.	26	45	24	29	1169	98	6	3	2	30
RIVERS AIRE AND CALDER UNITED.																																
Pontefract	.	1	.	2	5	2	.	.	.	.	.	.	12	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.
Total in entire Basin of the Rivers Aire and Calder	139	86	35	125	112	112	16	58	35	156	189	8	160	36	17	1	789	46	12	15	491	222	26	28	55	145	86	2050	99	52	11	2	31

LONDON:
Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty.
For Her Majesty's Stationery Office.

THIRD REPORT

OF

THE COMMISSIONERS

APPOINTED TO INQUIRE INTO

THE BEST MEANS OF PREVENTING THE POLLUTION OF RIVERS.

(RIVERS AIRE AND CALDER, &c.)

Vol. II.

MINUTES OF EVIDENCE AND INDEX.

Presented to both Houses of Parliament by Command of Her Majesty,

LONDON:
PRINTED BY GEORGE EDWARD EYRE AND WILLIAM SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.
FOR HER MAJESTY'S STATIONERY OFFICE.

17159.—2. 1867.

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MINUTES OF EVIDENCE

TAKEN BEFORE

THE COMMISSIONERS

APPOINTED TO INQUIRE INTO

THE BEST MEANS OF REMEDYING THE POLLUTION OF RIVERS.

INQUIRY INTO THE STATE OF THE RIVERS AIRE AND CALDER, AND THEIR TRIBUTARIES.

Wakefield, Tuesday, 16th October 1866.

PRESENT:

ROBERT RAWLINSON, ESQ., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, ESQ. | Professor JOHN THOMAS WAY.

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(*Chairman.*) Gentlemen,—the Commissioners appointed to inquire into the pollution of rivers appear here to receive evidence relative to the state of the rivers Aire and Calder and their tributaries, under the several heads set forth in the notice which has been duly advertised and circulated.

I will first draw your attention to the terms of the Commission, viz.: "Whereas we have deemed it "expedient for divers good causes and considerations "that a Commission should forthwith issue for the "purpose of inquiring how far the present use of "rivers or running waters in England for the purpose "of carrying off the sewage of towns and populous "places, and the refuse arising from industrial pro- "cesses and manufactures, can be prevented without "risk to the public health or serious injury to such "processes and manufactures, and how far such "sewage and refuse can be utilized or got rid of "otherwise than by discharge into rivers or running "waters, or rendered harmless before reaching them; "and also for the purpose of inquiring into the effect "on the drainage of lands and inhabited places, of "obstructions to the natural flow of rivers or streams "caused by mills, weirs, locks, and other navigation "works, and into the best means of remedying any "evils thence arising." This wording of the Commission is especially guarded, as it is not contemplated that the trade and manufactures of the country are to be injuriously interfered with, but that the inquiries shall be so conducted as to elicit the truth on both sides of the question. I mention this particularly, because some persons appear to be apprehensive that there may be such interference as to injure trade and manufactures. I think, however, upon calm consideration, you will see that the interests of the manufacturers of this county are of such vital importance, and so essential to the well-being of the whole community, that the Legislature will be very cautious how it does anything that shall be prejudicial to trade. If it is possible to diminish the pollution of streams, without serious injury to trade and manufactures, it will no doubt be the duty of Parliament to enact such laws and to enforce such regulations as shall be for the benefit of the whole district.

Mr. JOSEPH RHODES examined.

Mr. J. Rhodes.

1. (*Chairman.*) Are you mayor of Wakefield?—Yes.

2. How long have you been resident in this district?—60 years.

3. Have you paid attention to the condition of the streams in this district, so as to be able to speak to their present and their former condition?—Yes.

4. Will you state what was their former condition?—In my early days the river here was pure or nearly so. I am speaking of the river Calder. The water was then sweet and clean, and it was full of fish.

5. What kind of fish?—Roach and perch.

6. What is the general character of the manufactures carried on in this immediate neighbourhood?—Worsted spinning for knitting worsted; that is the main manufacture. That was originally started here. I think this is almost the only district, except Leicester and Aberdeen, where that kind of worsted is manufactured—knitting worsted and stocking worsted. A part is made in Manchester and a little in Glasgow. There is one firm at Manchester, and there used to be one very extensive one at Aberdeen, which perhaps manufactured as much as the people in Wakefield did.

7. What works on the banks of the river a little above Wakefield pollute the water?—There are some, particularly about Battley—Carr, and Dewsbury. They are all cloth manufactories in that district, and that sort of cloth is manufactured which is made almost without wool. They use rags, shoddy, &c., that makes the water worse still.

8. Old rags are worked up again?—Yes. Of course they use a portion of fresh wool, but the stream that comes down there is awful. It is quite sufficient to

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contaminate a river; but in all the valley up the river to Todmorden there are manufactories of various sorts of woollen and cotton. There are large works at Sowerby Bridge and Luddenden Foot. At Dewsbury and Ossett there are large woollen and worsted manufactories on the bank of the river.

9. Do all those works use water for cleansing and manufacturing purposes, and return the refuse back again into the stream?—Most of them; but the evil has been mitigated of late years by the owners of the mills saving their suds and utilizing them, making soap and oil from them again, but there is still a vast quantity of refuse coming into the river.

10. Are there any dyeworks?—Yes. Large works were in existence as far back as I can recollect. The Messrs. Holdsworths used to dye large quantities of woollen and stuff goods for the Bradford and Leeds people, and the chief recommendation was that we had such pure water here. I am afraid the superiority has now vanished, owing to the filthy state of the river.

11. Do you think that has led to the removal of the dye works, or diminished the trade in this district?—I believe that the dye works have not nearly so much business as they had; but I cannot speak particularly to that point.

12. Is the river liable to flood the land injuriously for any distance above or below Wakefield during heavy rains?—Very little. I think there are very few rivers that go down an open valley which cause less flooding. I think that the floods are fewer and to a much smaller extent than they were when I was a boy.

13. Do the towns and villages situated upon the river pass their sewage into the river?—I think every atom of it goes in, except what they save in the privies, and perhaps distribute on the land.

14. Where there are sewers on the margin of the river, the contents of those sewers are passed into the river?—Yes, they can go nowhere else, I believe. The river winds amongst hills. I do not see that the people could turn their sewage anywhere else. I have not heard of a single case where they save the sewage and utilize it.

15. Is it within your knowledge that persons owning sites on the banks of the river throw their ashes in, or refuse of any kind?—I do not know. I think they do much as they like; every one on the side of the river.

16. You think each owner on the banks does just as he likes?—I have not heard of any objection being made. I do not recollect any lawsuits. I have understood that the Messrs. Holdsworth some years ago did throw their ashes from their dyeworks into the river.

17. Have any complaints been brought before you as to the foul condition of the river since you have been mayor?—No public complaints, I believe, but complaints are universal throughout the town of the filthy state of the river. Only a few years ago boating was very pleasant on it. Now I should not like to go on account of the effluvia. It would do more harm than good.

18. What is the population of Wakefield?—At the last census it was 23,350.

19. What is its rateable value?—It was about 72,000*l.* last year.

20. Is the town of Wakefield sewered?—Half sewered. We are going to complete the sewerage now.

21. What becomes of the sewage?—It all goes into the river I am sorry to say.

22. Have you a local water supply?—Yes.

23. Is it supplied by a private company or by the corporation?—By a private company.

24. Where do they obtain the water?—From this river the bulk of it.

25. Is the water obtained by pumping from a point a little below the town?—Yes.

26. After the sewage of the town has been passed into the river?—Yes.

27. Is that water filtered or not?—It is filtered by Mr. Spencer's system, which I daresay is the best. It is of a little value to make the water drinkable.

28. In completing your system of sewerage have you borne in mind that you may be required to utilize the sewage and keep it out of the river?—I have mentioned that many times, particularly when we had a resolution as to the outlet sewers carried through the council. I mentioned that it would be much better to construct works to utilize the sewage as it came from the sewers. I have also opposed any alteration of the outlet, thinking it would be useless in a short time.

29. The question has been discussed or spoken of in the council?—I think there was no one but myself and Dr. Holdsworth who urged it on the council. I am rather diffident about it. I have not yet seen any good works, so as to be able to tell whether it would answer or not.

30. Has there been any discussion in the town council or in the town as to whether the water was of a desirable quality?—I am afraid that we are hardly awake to this question yet. Most people are not aware of the mischievous effects of such water as we are now drinking.

31. Have there been in the past summer any cases of cholera in Wakefield within your knowledge?—Only two or three cases a few days ago.

32. Are there any tanworks in the town or near it?—Not nearer than three or four miles off the stream. I believe that any refuse from those will ultimately come into this river.

33. Are there any public slaughter-houses in Wakefield?—Yes, one.

34. Are there any private slaughter-houses?—Yes, there are, which we have been obliged to tolerate.

35. Do you know whether the refuse from those slaughter-houses passes into drains and into the river?—I believe that most of it does.

36. And have you no check upon this?—I cannot be aware of all that is being done in the slaughter-houses, but I do know that some of the refuse goes into the sewer, and finds its way into the river.

37. Have you not considered the question of having general slaughter-houses for the borough?—No; and there is another thing. During the cattle plague we were compelled to kill all the cattle that came to the weekly fair in this town, which supplies meat for hundreds and thousands all round. We could not slaughter all in the borough slaughter-house. During the natural state of the markets the persons came and bought the cattle, and took them to their destination, and slaughtered them in those towns and villages where they were wanted.

38. Are there any gas works here?—Yes.

39. Do they belong to the corporation or to a company?—A private company.

40. Are they situated near the river?—No; they are about a mile away.

41. Have you reason to think that they tend to contaminate the river or not?—I cannot speak to that.

42. If there is any pollution, it is not a notorious pollution?—I think not. I suppose the tar and ammoniacal liquor and other products are taken away now, being saleable.

43. Is the scavenging done by contract, or are the cesspits of the cottages left to be emptied by the owners, or do you undertake the scavenging?—Something between the two. We are not bound to take away night-soil, or to remove nuisances. Our duty is to compel people to remove their own; but we found that so impracticable, and we were so alarmed about the cholera this summer, that we set our own men to empty all the privies and remove all the nuisances that we could.

44. The fear of cholera passing away, will you relapse into your old state of neglect?—I hope not. My period of office is nearly expired, but I have no doubt that my successor will endeavour to carry out improvements in the town.

45. Have you paid attention to the state of the

cesspits when they are being emptied?—Not at that time, because it is generally done in the night-time.

46. Did you ever happen to perceive a smell in the streets when the nightmen were working?—I have seen carts in the morning, and I have seen middens being emptied on the road, and they are very foul. I always keep away from them. Our inspector has particular orders from the council to get them all emptied, and to deodorize them with Dr. Bishop's powder while they are being emptied, and after they are finished. The powder is spread all over the place.

47. Did that rule apply before the cholera was apprehended, or was it merely a temporary effort?—We have been alive to that point for several years past. I think two or three years ago a deputation went to Leeds to inquire into the best means of getting rid of night-soil and deodorizing it. We got the powder then, and have used it regularly ever since.

48. Have you paid attention to the question of river purification, and formed any opinion as to whether any practical means may be found for mitigating the evil of river pollution?—I have entertained it very seriously many times, and I cannot see how to get out of it without an immense expenditure. If we had intercepting sewers from Todmorden (for that is the place where the pollution begins) it would be a most expensive piece of work. I think the best way to mitigate the evil is to get an ample supply of pure water from some distant grounds.

49. Do you think the getting an ample supply of pure water would avail if you turned it into polluted water?—It would not make the river fit to boat upon, but we should be able to have plenty of water for all manufacturing and culinary purposes. It would improve the current of the river, and mitigate the evil to a small extent.

50. Has your inspector of nuisances or scavenger authority from you to scavenge or cleanse the river. Suppose, for example, that carcases of dead animals are floating in it, is any person instructed to bury them?—No, they have no special instructions. I think the matter would come under the general instructions if there was a nuisance.

51. Has there ever been a scheme proposed to the town council for intercepting sewers to remove the sewage of Wakefield from the town and from the river?—Only a very imperfect one, to carry the outlet a little further beyond the railway bridge, which I thought would increase the evil. When we do carry our outlet further, I hope arrangements will be made to turn all the sewage on to the land. There is a situation very favourable for such a system; there are high hills with the ground sloping down for some distance all round about.

52. Is coal obtained near Wakefield?—Yes, under Wakefield we have all the beds, except one or two.

53. What is the commercial value of coal in the town of Wakefield?—Almost all the engines use smudge and small coals and dust.

54. What is the price per ton?—About from 2*s.* to 2*s.* 4*d.* at the pit, and it costs on an average 1*s.* a ton leading.

55. About 3*s.* 6*d.* at the outside?—Yes.

56. Has there ever been any proposition in the town council to purchase the existing water supply with a view to improving it?—Yes, we nearly made a bargain for it three or four years ago. We then called a public meeting, and the people there who knew more how to talk than to work upset our bargain.

57. If you had purchased those works, would it have involved an extension of them, or should you have abandoned the idea of bringing in water from any purer source?—We should have abandoned the river as a source of supply.

58. You would have procured water from a purer source?—We have not found one as yet, but we thought we might. We are at a distance from a purer supply, and to connect this town with any such supply would involve an immense outlay, perhaps more than the people of the present day would sanction.

59. Have you any written or printed report on the subject?—No; but there would be the minutes of our proceedings. I know that we spent a vast deal of time in looking at the sources round about. We considered the supplies the present water company proposed were not worth entertaining.

60. (*Mr. Harrison.*) Under whose management is the river?—I think we have nothing to do with the river; it is like private property.

61. Whose property is it?—The Aire and Calder Navigation Company's.

62. All of it?—Yes, and the Calder and Hebble. I think they are amalgamated now; a lease exists.

63. Are there commissioners whose duty it is to see that the Aire and Calder Navigation Company do their duty?—I am not aware.

64. When you looked into the question of applying the sewage to the land, did you find that there was any difficulty in obtaining land for its application?—I believe not.

65. Should you have to pump the sewage or apply it by gravitation?—We must pump it.

66. Has any report been drawn up upon the subject by the surveyor or others as to the application of sewage to land?—I think not. Our late surveyor went with me to look over the land twice, and we suggested a system that might be carried out very well, so as to rid us of all our sewage. We should have required a pumping engine, and a reservoir on the top of a hill, and pipes from that.

67. (*Chairman.*) Supposing the legislature passed an Act making it imperative that the pollution should cease as far as practicable, and that there should be a local conservancy board with ample powers, has it occurred to you what form that board should take?—I have never thought of having any separate body for managing that matter. I have thought a committee of the local board could manage it quite well with the assistance of an engineer.

68. Do you think that a committee of the local board could be entrusted to interfere with those matters, with dyers, and other persons beyond your borough, because the pollution does not only consist of that which takes place within the borough, the river is polluted up and down; in fact from its source to its estuary?—I have not given that any thought; there are some trades that require so much water that they could not dispose of the refuse in any other way, unless by having intercepting sewers.

69. You see a difficulty in the way?—Yes.

70. I suppose that the success of many of these manufacturing operations, especially in the case of dyers, in some degree depends upon the volume, and perhaps more upon the purity of the water they have to use?—Yes.

71. If any practicable means could be found by which that water should be returned to the river in a much less polluted condition, it would be for the advantage of the persons using that water below?—Certainly.

72. It might not be to the advantage of the persons who polluted it above if they had to incur expense in making it comparatively pure?—They might be compelled to form reservoirs, and perhaps filters, between the reservoirs and the river.

73. Seeing the condition of the river, would it be an intolerable hardship if the abusers of the water who make a profit by abusing it were compelled to apportion some of that profit to restoring the water again to a comparative state of purity?—I think, if it was a hardship, they ought to be compelled to adopt any system that would improve the water.

74. Any system that would not be absolute ruin to the trade?—Yes. I am afraid the pernicious salts could hardly be got rid of. They could not be filtered out. The best system for making the water as good as we could would be to have subsiding reservoirs, and a filter besides, through which the water should be passed before being turned into the river again.

75. (*Mr. Harrison.*) When were the waterworks established at Wakefield?—In 1837.

76. When did you carry out the partial sewerage of

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the town?—I do not know; it may have been one hundred years ago for what I know.

77. Was the outlet you speak of, which is above the point from whence the water is drawn, in existence when the waterworks were established?—Yes, I remember it when I was quite a child; how long it was made before then I do not know.

78. Have you extended the sewers in the town since the waterworks were established so as to bring down more sewage to that point?—Yes; but we have not had any extensive increase of sewage, I think, till last year and this; we are now trying to carry out the whole system.

79. Is the population of Wakefield increasing?—Yes, it has increased more in these last two or three years than perhaps in 10 or 20 years before.

80. You object to the water of the Calder as a source of supply to the town, in consequence of the pollution by the towns above as well as of the pollution that is caused in Wakefield?—Yes. I do not think any chemist could make that water fit to drink.

81. (*Professor Way.*) Do you think that the refuse of manufactories or the sewage of towns causes the greatest evil in the river Calder?—I can hardly answer that question.

82. I think you said you were an advocate for the application of sewage to land?—Yes, if I thought it could be made to pay, or that it could be done at an expense of 500*l.* or 1,000*l.* a year to the town, I should advocate it.

83. (*Chairman.*) If it is practicable to do it at a moderate cost, you would say that the town ought to be made to do it?—Certainly.

84. You mention that Dr. Bishop's powder had been used for sanitary purposes; do you know what that is?—I fancy it is charcoal and perhaps sulphuric acid.

85. Is Dr. Bishop a local person?—He is a Leeds gentleman. I think there is a company for manufacturing the powder.

The witness withdrew.

Mr. Henry Morgan, Deputy Town Clerk, read a report which had been drawn up by the Town Clerk, Mr. James Whitham, and handed in the same, as follows:

In 1771 (11 Geo. III.) an Act of Parliament was passed for the better paving, repairing, and cleansing the streets, lanes, alleys, and other public passages within a certain portion of the town of Wakefield, and which at that time comprehended very nearly the whole of the town. By this Act certain commissioners were appointed to carry out the sewering, paving, and cleansing of the town. Previous to the passing of this Act, the sewage of the town used to find its way into the river Calder by two channels. One channel was a beck or stream, called the Skitterick, which rose at East moor (on the east side of the town) flowed through the town across the street of Wrengate and along the back of the street called Kirkgate for about half way down the street, when it diverted into the middle of the street until it emptied itself into the river near the ancient Soke Mill and near to the spot where the present outfall is. The other channel was an open ditch which used to flow down the street of Westgate, in a westerly direction to Westgate, otherwise Ings beck, and which beck emptied itself into the river a little above the Soke Mill Dam.

The Commissioners under the above Act continued in existence till May 9 1853, when Stat. 16 Vict. cap. 24 was passed, and which repealed the Commissioners Act, and directed that all their powers should cease, and that the Corporation of Wakefield should be the Local Board of Health for the whole of the borough of Wakefield and carry out therein the provisions of the Public Health Act.

Soon after the passing of the Act of 1771, the Commissioners made sewers in Kirkgate and Westgate, and covered over the open becks or ditches, and diverted them into the sewers, and instead of the sewage flowing into the Soke Mill Race, the Commissioners made a syphon sewer under the mill race and emptied it into the river. This outfall remains in the same place to this day (except that the Local Board enlarged it), and ever since 1771 to the present time this outfall has formed the main outlet for the sewage of Wakefield.

Shortly after the application of the Public Health Act to Wakefield, the Local Board turned their attention to the sewage question, and made several attempts to provide a better outfall, and if possible to free the sewage water from the sewage before the water reached the river, but their attempts have hithetro been unsuccessful. On reference to the corporation minutes, it appears that on July 13, 1853, the Local Board directed their then Surveyor to suggest an improved outlet, having regard to a general system of sewerage for the Borough, but he was incompetent to the task, and nothing was done.

On February 6, 1856, the then Borough Surveyor reported in favour of a new outfall being made nearly a mile lower down the river than the present one and near the railway bridge across the river with deodorziing tanks so as to render the sewage water flowing into the river comparatively pure. The Local Board did not adopt this report, but recommended their Surveyor to make inquiries at various places where experiments had been made as to the disposal of sewage. In the meantime the Local Board directed the enlargement of the existing outfall, which was done.

The Wakefield Waterworks Company and the Aire and Calder Navigation Company having heard that the Local Board contemplated making a new outfall near the railway bridge, the former Company on October 6, 1856, and the latter Company on October 25, 1856, served notice upon the Board of their intention to take proceedings at law and in equity against the Board in case the new outfall were made.

On 17th November 1856, the Board appointed a Committee to consider the objections of the above Companies and to make inquiries and obtain information generally as to the best mode of making the proposed outfall sewer near the railway bridge and disposing of the sewage refuse, and on 4th February 1857, the then Borough Surveyor by the direction of this Committee, reported to the Board on the subjects referred to the Committee and the report was printed.

After considerable discussion, however, it was determined not to make the new outfall, and deodorizing works connected therewith in the face of the opposition of the above Companies but to wait until a Commission to be appointed by the Government should devise some scheme for the disposal of the sewage.

James Whitham first knew the river Calder in 1820. It was then nearly as pure as river water ordinarily is, and fish were numerous both above and below the Soke Mill Dam, and this state of things continued pretty nearly in the same position till about 30 years ago, when the river began to get gradually polluted, and the pollution has been going on increasing from that time to the present. The river is polluted nearly as badly as it can be before it reaches Wakefield.

The Wakefield Waterworks Company derive the principal portion of their water from the river, about three miles below the town, the residue being supplied from land springs. The waterwoks were first established by virtue of an Act passed 8 June, 1837, which authorized a share capital of 15,000*l.*, in shares of 25*l.* each, with power to raise an additional 5000*l.* by mortgage. In 1861 the Company gave notice of their intention to apply for another Act to authorize them to obtain an addtional supply of water from the neighbourhood of East Ardsley and about four miles nearly north of Wakefield. The Local Board caused this scheme to be examined by Mr. Bateman and the water to be analyzed by Mr. Dugald Campbell, and these gentlemen respectively having reported that the supply would be deficient and that the water was not fit for human consumption the Board petitioned against the Bill, and entered into a negotiation with the Company to purchase their works with a view afterwards to adopt a better scheme. In March 1862 the Company and the Local Board settled in writing the terms of an agreement whereby the Board were to purchase the Companies' works at the price of the then share capital (28,500*l.*), to be paid on 1st July 1870, with interest from 1st July 1863, when the Board were to take possession, subject to all the liabilities of the Company at the latter date. The Company were to abandon their Bill except so far as related to the money part, and the expenses of the Company were to be paid by the Board. The Board were to apply in the then next Session for an Act to carry the agreement into effect and were to be at liberty to include in such Act powers for obtaining supply of water and other usual powers. The agreement was to be subject to the confirmation of a public meeting of the inhabitants of Wakefield and of 3/5ths of the shareholders in the Company.

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On 24 March 1862, a public meeting of the inhabitants was held, when the following resolution was carried by a large majority:—

"That in the opinion of this meeting it is inexpedient for the Wakefield Town Council as the Local Board of Health of this Borough to purchase the works, lands, premises, rights and privileges of the Wakefield waterworks.

In consequence the contemplated purchase was abandoned, and on the following day it was agreed between the Board and the Company that the Company should abandon their new water scheme, and should make their bill simply a money bill, and that the Board should withdraw their opposition to such bill.

On 30 June, 1862 the new Act of the Company (25 and 26 Vict., c. 99) was passed. It totally repeals all former Acts of the company. Sec. 13 enacts that the capital of the company shall consist of 840 25*l.* and 600 12*l.* 10*s.* shares already created, and of such shares as might be created under the powers of the new Act. Sec. 15 gives power to create new shares to the amount in the whole of 26,500*l.* Sec. 20 gives power to borrow 13,700*l.* Sec. 39 gives power to the company to maintain and improve their existing works, and (expressly) to take water from the Calder. Sec. 50 defines the limits of the Act to be the town and township of Wakefield, and the townships of Alverthorpe with Thornes Stanley cum Wrenthorpe and Sandal Magna. Sec. 51 fixes the following rates for water rents for domestic use in a dwelling-house:—

	£
Old Capital	21,000
Do.	7,500
New Capital	26,500
	£55,000
Power to borrow	13,700
	£68,700

Annual rent or value not exceeding	£	s.	d.	
Do.	10	0	14	0 per year
Do.	20	1	4	0 „
Do.	30	1	15	0 „
Do.	40	2	5	0 „
Do.	60	3	0	0 „

Above 60*l.* 5 per cent. upon the annual rent or value, and the Company are not to be obliged to furnish a supply to any owner or occupier for less than 10*s.* a year. Sec. 52 enacts that the water rent shall be payable according to the actual rack-rent or value. Sec. 53 enacts that domestic purposes shall not include waterclosets, or cattle, or horses, or washing carriages let for hire, or for any trade, garden, or ornamental purpose. Sec. 54 enacts that waterclosets shall be charged 6*s.*, and baths in houses 8*s.* each. By sec. 56 the Company may supply water for other than domestic purposes by contract. By sec. 61 the Company shall not be bound to supply water to the Corporation for public purposes at a lower rate than the lowest rate that the company charge to the largest consumers.

Since the passing of their last Act the company have laid out a considerable sum of money in a new pumping engine, larger mains, and in carrying out Mr. Simpson's plan of filtration; but the evidence as to these points will be given by other witnesses.

Mr. H. Morgan.

Mr. Henry Morgan (Deputy Town Clerk of Wakefield) examined.

86. (*Chairman.*) What is the area of the borough?—1,553a. 2r. 30p., and the population is 23,350, according to the last census.

87. Has it increased since that time?—We estimate it now to be 25,000.

88. What is the rateable value of the town?—In round numbers, 71,000*l.*

89. Has the corporation authority over the police?—Yes.

90. And the lighting, watching, and scavenging?—Yes; the Municipal Corporation Act is in force in Wakefield, the Public Health Act, and the Local Government Act.

91. Are there any independent townships that have separate jurisdictions?—Not any. I may state that the borough of Wakefield consists of the whole of the township of Wakefield, and parts of the townships of Alverthorpe with Thornes, and Stanley with Wrenthorpe.

92. (*Mr. Harrison.*) What has been the cause of the increase of the population since 1861?—Trade seems much better than it was some few years ago; there have been many more new buildings erected, and more manufacturing has been going on.

93. What are those manufactures?—I think the principal increase has been in the worsted manufacture; also some large ironworks have been established in Wakefield, and a cocoa-nut fibre company.

94. Are there any dyeworks in the town?—I have begun to make a list, and I will complete it for the Commissioners; but so far as the names have been taken out (and the last work has been done by one of the officers of the corporation), there are in Wakefield now 11 worsted, woollen, and cloth manufactories, four fibre mills, two soap and greaseworks, nine dyeworks, 58 malt kilns, and five large breweries; but, in addition to the breweries, there are about 65 publicans who brew themselves. The number of the flour mills has not been taken out, because it was supposed they would not pollute the stream.

95. Do all those trades you have mentioned more or less pollute the stream?—Yes. There are also some three or four chemical works, which will more or less pollute the stream.

96. What is manufactured there?—I do not know. Messrs. Hicks are manufacturers of copperas and sulphate of iron.

97. Are the dyeworks on a large scale?—One or two of them are on a large scale, for instance, those of Messrs. Holdsworth, and Messrs. Hodgson, Shaw, and Dent, a little above the dam.

98. Does all the refuse from their works go directly into the river?—I believe it does. In addition to those places there is the prison, which discharges, I believe, all its refuse—or they did so till very recently—into sewers which run into the river.

99. Is the system of waterclosets carried out to any great extent in the town?—I believe information will be given to you as to that by the surveyor, but I understand there are about 350 waterclosets which are supplied by the water from the waterworks company, and an estimate has been made as to the number of the waterclosets which have cisterns, and they are perhaps 200.

100. (*Professor Way.*) You say there are 58 malt kilns?—Yes.

101. Do they pollute the river?—Complaints have been made to the corporation at different times about smells and other things arising from the sewers in connexion with those malt kilns.

102. Is any part of the barley likely to be thrown into the sewers or the river?—That I cannot say. I only know that there have been frequent complaints made of very offensive and bad smells from drains connected with the breweries.

103. You spoke of cocoa-nut fibre being manufactured?—Yes, cocoa-nut fibre and china grass.

104. What is that?—Rhea.

105. Does it go through a chemical process in preparation?—I cannot say.

106. Is it within your own knowledge that the river was comparatively pure, and contained fish within the last 25 or 30 years?—I have seen fish in the river 18 years ago.

107. Was that above or below the town?—It was near the bridge. I have seen people getting them out.

108. Are there no fish in the river now?—Not of any kind.

109. No eels?—No.

110. (*Mr. Harrison.*) When the Aire and Calder Navigation Act was first passed there were two bodies: contractors who undertook the execution of the work, with whom it was a speculation, and Commissioners, whose business it was to look after the contractors, to see that they did their duty. Do

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those Commissioners still continue to act?—I am not aware that there are any Commissioners.

111. You say that since the waterworks were established, in 1837, waterclosets have been largely introduced, and that the outlet of the sewers is in the same place as it was before; there must therefore be a much larger quantity of sewage issuing at that point than before waterclosets were established?—Yes, owing to the increase of population. In addition to that, I believe that the Local Board of Health, since its establishment, has caused many ashpits to be drained, the contents of which find their way into the sewers.

112. (*Professor Way.*) Was the outlet at first established for the purpose of the surface drainage of the town, and was it made use of subsequently for the drainage of the cesspools?—At first, of course, it would have been for the surface water.

113. Do you live in the town?—Yes.

114. What water is supplied to you?—From the waterworks.

115. Do you drink it?—Yes.

116. Do you like it or dislike it?—I dislike it; but the water is very much clearer this year than it has been for many years back.

117. Has that been since the introduction of the new system of filtration?—Yes, it is very much harder. I have to use much more soap in washing now.

118. (*Mr. Harrison.*) Have you any analysis of the water?—No. I have here a paper which I have drawn out, showing the rateable value of the property within the borough.

The same was handed in as follows:

BOROUGH OF WAKEFIELD.

	1851	1861.
Population of the Borough -	22,066	23,350

Rateable value of Property.

	£	s.	d.		£	s.	d.
1848 -	56,596	15	4	1858 -	62,652	10	0
1849 -	56,909	17	4	1859 -	61,131	18	8
1850 -	57,759	6	7	1860 -	60.205	1	2
1851 -	No Rate.			1861 -	60,855	8	4
1852 -	58,376	6	2	1862 -	61,258	8	5
1853 -	59,165	13	0	1863 -	62,242	17	3
1854 -	59,513	18	2	1864 -	63,439	1	11
1855 -	59,591	8	7	1865 -	70,844	18	3
1856 -	60,062	19	1	1866 -	72,461	9	5
1857 -	59,998	12	9				

The witness also handed in the following papers:

BOROUGH OF WAKEFIELD.

RIVERS POLLUTION INQUIRY.—RETURN of the number of Mills, Manufactories, Dyeworks, Maltkilns, Breweries, and other places discharging refuse into the river Calder, or into streams communicating therewith.

Worsted, Woollen, and Cloth Mills -	12
Fibre Mills - - - - -	6
Soap and Grease works - - -	3
Dye works - - - - -	9
Maltkilns - - - - -	58
Breweries - - - - -	5
Brewhouses chiefly attached to Public-houses	60
Public slaughterhouses - (in one block)	5
Private ditto. - - -	23
West Riding Prison - - -	1
West Riding Asylum - - -	1
	183

BOROUGH OF WAKEFIELD.

RIVERS POLLUTION INQUIRY.—POPULATION of the principal Towns and places on or near the banks of the Calder between Todmorden and Wakefield both inclusive. Taken from the census tables, 1861.

Todmorden - - - -	11,797
Luddenden - - - -	3,008
Sowerby Bridge - - -	5,382
Hebden Bridge - - -	10.826
Skircoat - - - -	7,447
Halifax - - - -	28,990
Southowram - - - -	7,245
Elland - - - -	3,643
Brighouse - - - -	7,340
Mirfield - - - -	9,263
Dewsbury - - - -	18,148
Thornhill - - - -	3,479
Horbury - - - -	3,246
Wakefield - - - -	23,350
	143,164

POPULATION of the districts through which the River Calder passes. Taken from the census tables, published by authority.

—	1801.	1811.	1821.	1831.	1841.	1851.	1861.
Todmorden	15,550	19,320	24,852	28,622	31,656	29,727	31,113
Halifax -	52,027	59,475	75,190	89,739	109,073	120,958	196,475
Dewsbury -	29,730	34,832	41,668	50,232	60,709	71,768	92,883
Wakefield -	27,617	30,552	35,666	38,376	45,698	50,614	55,049
	124,924	144,179	177,376	206,969	247,136	273,067	375,520

The witness withdrew.

Mr. J. Oakes.

Mr. JAMES OAKES (of Wakefield) examined.

119. (*Mr. Harrison.*) Are you a native of Wakefield?—I was born near the banks of the Calder, a mile above Wakefield, and I have a familiar acquaintance with the river from Wakefield Bridge up to Lupsett, about two miles above Wakefield. From 1826 to 1830 I had, during the greater part of the year, to cross the river twice every day, and walk a quarter of a mile down its banks. I have frequently bathed in it during that period, and spent many of my Saturday afternoons fishing in it. I have frequently drunk the water, and seen other persons drink it. I have seen at Wakefield Bridge, and in other shallow parts, hundreds of fishes at certain periods of the year. I have seen pike of all sizes taken out during the floods, and I have seen trout up to three pounds in weight—up to 1830 I speak of—and I think I can confirm the statement of the town clerk that the water was as pure as rivers ordinarily are. I think I may say from recollection that the water was as pure as that which the waterworks company furnishes to us now. I do not wish to say anything against the company's water, for I do not use it. Last year the water just below Lupsett Dam, which is nearly two miles above Wakefield, and therefore not contaminated by Wakefield, was really filthy. To one standing on the bank of the river at that time (last September) the smell was almost unendurable, and enough to make one ill. I do not think that there is a single fish in the river during all that length, from Wakefield down to the place I have mentioned.

120. Did you ever find the condition of the river to be the cause of ill health to any of the inhabitants on the banks?—I find that it has been the cause of fever in what is called Thorne's Lane, about half a mile above Wakefield Soke Mills, during the last summer and the summer previously; at least, the fever was believed to be caused by the bad smell of the river. I walked two years ago from Wakefield Bridge to Stanley Ferry, which is a little above the waterworks, and the colour of the water was black, and all along the bank for several feet towards the centre of the river, the water was covered with a slimy, offensive looking material.

121. What was the condition of the bed of the river between 1826 and 1830?—It was clean gravel.

122. What is its condition now?—Now, in many places there is a black deposit.

123. Of what thickness?—I cannot say.

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124. Within the borough of Wakefield there are large dyeworks?—Yes.

125. Was wool from Bradford and other towns formerly brought to Wakefield to be dyed?—Yes, a good deal.

126. Was there more dying carried on upon the upper parts of the Calder and the Aire at that time?—I think not; it was chiefly done here.

127. Since then dye works have been established on different parts of the river above Wakefield?—They have, but there is some Bradford trade now done in dyeing. I do not think, however, that the establishment which has been referred to does more than half the business it did 30 years ago.

128. What was the condition of the river in 1837, when the water works were established?—I think the condition of the river was very much better than it is now. I was not resident in the town then. I speak distinctly of the period from 1826 to 1830.

129. You have been away?—Yes; from 1833 to 1840 I was away.

130. Did you observe a great alteration in the condition of the river when you returned in 1840?—Not much; it has taken place since that time. There were fish in the river then. It was common to see fishermen passing through our village to the river, but that has ceased during the last 15 or 20 years.

131. To what do you attribute the altered condition of the river?—I believe that the chief mischief to our river comes from above. I do not think there is any material pollution from Wakefield, except what occurs from an increase of population. The worsted has to be scoured to get the oil out. When I was a youth all the worsted manufactories sent their refuse into the river; now all that grease is recovered; the liquid is run into cisterns and evaporated.

132. Is that system carried on in Wakefield?—At every manufactory suds are saved in a cistern, and purchased by a party who refines them. I should say that in consequence Wakefield causes less pollution to the river than it did 40 years since, except so far as there may be increased pollution from increased population.

133. From the sewage, and from the use of waterclosets?—Yes. As far as manufactories are concerned, I do not think Wakefield pollutes the river so much as it did then.

134. What was the population of Wakefield in 1820?—From 12,000 to 14,000, but I cannot say positively.

135. (*Professor Way.*) You spoke of some cases of fever which were supposed to be due to the state of the river; was there any official notice taken of those cases?—I believe so.

136. Were any complaints made?—I believe so.

137. Can you name the surgeon who was in attendance?—I cannot. The drains in that part are liable to be flushed by the floods in the river.

138. What class of manufactories do you consider most pollutes the river?—Dye works.

139. Do you think that if the river Calder had remained at Wakefield as pure, or comparatively as pure, as it was some years ago, the dyeing processes, instead of falling off, would have increased very largely?—I have not the least doubt of it. What brought the trade here was the reputation that the water was so pure here, and the dyeing consequently superior.

140. Then the dyers are their own victims, in fact?—It seems so.

141. Are you familiar with manufactures to any extent?—No.

142. Do you believe that the manufacturers will take any means to purify the water if it is not made compulsory upon them?—I do not think they are willing to do so; nothing but compulsion will accomplish the matter.

143. (*Mr. Harrison.*) The mayor stated that the river Calder was very little subject to flooding. Is that the case within your knowledge?—It more frequently overflowed 40 years ago than it does now. My father had a field near to the river, and when there was any considerable flood the lower part of the field was covered with water. I have seen a deposit of an inch or an inch and a half on the lower part of that field, but of late years, I do not know from what cause, the floods have not been so high, and the field is not so liable to be covered with water.

144. I suppose in 1852 the river overflowed its banks considerably?—Yes. I have heard the old folks speak of very considerable floods, but we have nothing like them now.

145. (*Professor Way.*) The town of Wakefield does not suffer much from flooding?—No.

The witness withdrew.

Mr. John Edward Dibb handed in a printed paper, headed "On the Water Supply," by Mr. G. F. Naylor.

Mr. J. E. Dibb.

146. (*Mr. Harrison to Mr. Dibb.*) Have you read this paper?—I did, very carefully, at the time of its publication.

147. Do you think that reliance can be placed on its contents?—I think it is a most singularly reliable paper. I do not think I ever read one more clear and distinct and logical on any subject whatever. I may mention that I have in my house a spring of remarkably clear and brilliant hard water, but I have for many years deliberately closed it, and have used the water of the waterworks company because I found the spring water so hard as to be detrimental to health. I always subject the water of the company to additional filtration in the house, and I believe that the health of my family has been considerably enhanced by adopting the waterworks water in place of the clear spring water.

148. What is your process of filtration?—I have several. I use Dahlke's Patent Water Purifier, recommended by Dr. Letheby, and adopted by the Drinking Fountain Association, supplied by S. Maw, Aldersgate Street, London. It is a white china filter, with a charcoal medium, and it has a singularly brightening effect on the water.

149. Have you been many years resident here?—Yes, since 1840.

150. You probably heard the evidence of the last witness as to the increased pollution of the river since then?—Yes. My belief is that the increased pollution of the river mainly arises from the additional sewage, which additional sewage chiefly results from an increase of the population and the waterclosets set up since the establishment of the waterworks company.

151. (*Professor Way.*) Your observations have reference to the water below Wakefield. What can you say as to the condition of the water above Wakefield?—I have no practical knowledge of that.

Mr. Joseph Johnson (Inspector of Nuisances of Wakefield) examined.

Mr. J. Johnson.

152. (*Mr. Harrison.*) Have you been long resident in Wakefield?—Yes, I was born here.

153. How many years have you been inspector of nuisances?—About 14.

154. Under the corporation?—Yes.

155. As a local board of health?—Yes.

156. Has the condition of the town improved during that time?—Many sanitary improvements have been made.

157. What have they consisted of?—Making drains in a great many of the bad streets, and improvements in the privy accommodation. Ash-pits have been rebuilt; old ones have been taken down that were in a bad state, and new ones substituted.

158. And water closets introduced?—Yes, in some instances; but many of the ash-pits have been improved.

159. What has been the effect of those improve-

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ments as to increasing or diminishing the quantity of refuse discharged into the river?—We have no less discharged into the river, but more. It is not allowed to lodge on the premises in the cesspools and such like.

160. Have many of the cesspools been done away with entirely?—Yes.

161. But not universally?—No.

162. What proportion has been done away with?—There exist but very few, only in the localities where drains have not been made; but we are making drains there now.

163. So that almost all the sewage and refuse of the town now goes into the river?—It does.

164. Has that occurred within the period of your being inspector of nuisances?—It is more the case now than it was when I first took office.

165. Before that there were cesspits, and the contents were carted away into the country?—Yes, by the farmers.

166. And that refuse is discharged into the river above the point from which the waterworks company take their water?—It is.

167. (*Chairman.*) How many ashpits are there in Wakefield?—About 1,400 or 1,500.

168. What size are they generally?—They vary considerably, according to the number of the houses. As a general rule they are about three yards by two.

169. Of what depth are they?—About a yard below the surface.

170. What quantity might be taken out of one of those ashpits in the shape of horse-loads?—About three 2-horse loads on an average.

171. How many 2-horse loads of that refuse is carted out of Wakefield in a year?—The smaller ones have to be emptied out about three times a year, and the larger ones perhaps twice a year.

172. Might I say that the 1,500 were emptied twice a year?—Yes.

173. That would be about 9,000 2-horse loads in a year?—Yes.

174. Have you ever seen any of those ash places overflowing with the soil from the privies?—Yes.

175. On the floor of the privy?—Yes.

176. And overflowing into the yard?—Not exactly into the yard.

177. Are any of those ashpits or middens situated close against the walls of dwelling-houses?—Yes.

178. Are any of them situated underneath buildings that are inhabited?—Yes.

179. Underneath the rooms?—Yes.

180. Have any complaints been made by the inhabitants of the houses adjoining, or those living in the rooms above?—Yes, occasionally.

181. Have you known fever prevail in those houses?—I have.

182. Of what kind?—Typhus.

183. Do you remember any special time or year when it was worse at one time than another?—It has been as bad this year in some parts of the town as ever I knew it.

184. Since last Christmas?—Yes.

185. Has it been a wet year or a dry year?—In the spring we had dry weather, and in the summer it was dry.

186. What kind of weather have you had during the autumn?—Very wet.

187. Long-continued wet?—Yes.

188. When has disease been worst; in dry weather?—No, in the wet weather.

189. At what time do you empty those ashpits; at what hours?—Chiefly in the night. Between 9 at night and 8 o'clock in the morning.

190. Have you, as inspector of nuisances, attended much during the time that the cesspits have been emptied?—Yes, very often.

191. Do any of the inhabitants complain when they are being emptied?—They complain when they are not emptied.

192. Do they complain when they are emptied?—Not often

193. They are glad to get the material taken away?—Very glad. It is the greatest difficulty in Wakefield.

194. Are those ashpits usually situated behind the dwelling-houses?—Yes.

195. Are there always passages or yards by which they can be approached?—Yes.

196. Have you known instances where the material has been carried or wheeled through the interior of the house into the lobby?—Yes, there are several instances in the town where the material must be taken through the dwelling-houses and front shops.

197. What condition are they in when the cesspits are being emptied?—They are very bad; but I obviate the evil by letting the people have disinfecting powder.

198. To mix with the refuse?—Yes.

199. Under any conditions it is an intolerable nuisance to the people at any time?—Yes, it is indeed.

200. Are there many waterclosets in the town?—Yes.

201. In what class of property are they?—In the better class of property.

202. Are there any attached to the cottages?—Some few, but they have not answered from the fact that the occupiers have not flushed them. They have abused them very much, and the owners have been put to very great expense. The local board of health would have carried them out to a greater extent had the occupiers paid proper attention to them.

203. Is there any difference in the people of Wakefield, as compared with those in London, in the use of such kind of accommodation?—I am sure I do not know how they do in London. It is very difficult to deal with them here.

204. In those places where conveniences are situate under the rooms, or in close contact to the dwelling-houses, would it not be a great improvement if the ashpits could be abolished, and the soil passed away daily?—That has often occurred to me.

205. There would then be nothing but dry ashes to deal with?—No; and it would be more healthy in these confined parts of the town.

206. Would it cost the town any more to remove those ashes every week, instead of twice a year?—Yes, a considerable deal more.

207. Why?—In the first instance it does not devolve upon the local authorities to do it. The law, as it at present stands, compels the occupiers to do it themselves.

208. Why then should they express pleasure at the contents of their ashpits being removed if the removal depends upon themselves?—Because they have a great difficulty in getting the farmers to remove it.

209. The farmers will only take it at such times as their teams are not otherwise occupied?—Yes.

210. When does that occur?—The greatest difficulty occurs during hay time and harvest and seed time.

211. Do the people pay the farmers for taking it away, or do the farmers pay for the privilege of taking it away?—The inhabitants are very glad to give it.

212. Have they to give anything in addition?—In some instances they do.

213. Would it not be a general benefit if the borough undertook regularly and systematically to cleanse all those places, irrespective of the convenience of the farmers?—The town would be much more healthy.

214. Would the process be much more costly?—I think so, and I will show you why. The local board at times, when the town is in a very bad state, directs me to employ men to remove this soil, and in doing so we have had at times to shoot it into quarries and bury it. That has been the only means we have had to get quit of it.

215. That would occasion an increased cost?—Yes.

216. What do you suppose it costs now each owner to cleanse his ashpit?—Taking it as a matter of cost, it is not much. Men already go to clear out the

dust-bins; but the greatest difficulty is where there is a long way to wheel up long passages and very narrow. The work requires a great deal more labour, and there is more expense in finding lights.

217. Have you any trouble with the private slaughter-houses?—Not a very great deal of trouble.

218. Are those places kept clean, or are complaints made about them?—Taking Wakefield as a rule, and the slaughter-houses in other towns, I think there are none to beat Wakefield.

219. Do you mean private slaughter-houses?—Yes, private ones. The public one has not been kept so clean as I should like to have seen it, and sometimes I have brought the parties before the magistrates for neglecting their duties.

220. Does it belong to a company?—Yes.

221. If the corporation owned the slaughter-houses could things be carried on better?—I think the slaughter-houses could be kept much cleaner and be managed much better. They are now leased by the butchers themselves for their own accommodation, and they have put a man in to manage them or rather mismanage them.

222. What becomes of the refuse that is made at the public and private slaughter-houses?—It is carted away by the farmers.

223. What do they do with the blood?—It is at present sent to Manchester; it had for some years been taken to Leeds.

224. To be used for manufacturing purposes?—Yes, for cloth establishments, in cleansing and scouring.

225. Have you any knowledge as to whether cattle are at all injured by drinking polluted water?—Cattle will not drink the water that comes down this river now. I have seen cattle drink it formerly. It used to be a regular occurrence to take the horses into it to drink it, and also cattle; but in consequence of its impurity they are not taken there now.

226. Will not cattle drink out of a farmyard pond, which receives a considerable amount of drainage from the yard?—If the water is good.

227. You say that they will not drink the river water?—They will not.

228. Have you seen much of the recent cattle plague?—Yes.

229. Has it prevailed much in the vicinity of Wakefield?—Not so much as in some other parts.

230. Have you had any diseased cattle that have died or have been slaughtered in Wakefield?—Yes.

231. Where did you bury them?—At the outskirts of the town.

232. In such positions that the matter from them could get into the watercourses?—It could not.

233. Do you find any difficulty in performing your duties as inspector of nuisances; are you resisted at all by parties?—Not in a general way, and I am pretty well received by the inhabitants.

234. (*Mr. Harrison.*) You mentioned that the ashpits were a great nuisance to the neighbours frequently before they were removed, and that people complained of them?—Yes.

235. Have there been cases of sickness arising from those ashpits?—Not that I am aware of. I am always very pleased to supply disinfecting powder when I know they are in a bad state. I am now sending a cargo of refuse away by boat to farmers in the country, and I shall report to the local board of health what success I have had, how much the removal has cost, and what I have made of the refuse. It is likely to improve the state of the town without any material loss; and I do not doubt that the local authorities will carry some such regulation out.

236. What do you expend for the borough in a year for disinfecting powder—take this year?—I laid out for the borough about a month ago 4*l*. I gave that for a ton of Dr. Bishop's powder from Leeds.

237. How long will that last?—Perhaps two or three months yet. We also use quicklime and soot.

238. To what cost is the borough put altogether for disinfectants of one kind and another in a year?—It would not run over 10*l*. a year altogether.

239. I think you stated that there had been typhus fever arising from the state of the cesspits?—I did not say that exactly; but it is in some of the worst parts of the town, the lower parts, near the railway station, that are the most enclosed.

240. Are those parts inhabited by people who come upon the rates for relief?—Yes, occasionally; but it is only through their own bad habits; they are people who could get plenty of good work if they would only attend to it; but instead of that they are an improvident class, and spend their money in drink, and for want of a proper regard to cleanliness they bring on this disease themselves.

241. It would be for the benefit of the town if the condition of their houses were improved?—Yes.

242. And in that way relieve the rates?—Yes. I may state also that the medical officer of the local board of health examined into the matter, and also the borough surveyor, and as an effect of their examination the local board have given notice to drain that part and to put in proper stench traps, and I believe that all those regulations will speedily be carried out.

243. Are the nightmen who are employed to remove the contents of those cesspits ever affected?—I never knew but one. I sent a man into one place, it was a cesspool where the gases were quite confined; he ignorantly went into that place, and there were hundreds of gallons to be removed, and the gases made him ill; he went home and was taken with typhus fever. That is the only case that I have known.

244. (*Chairman.*) How long ago was that?—About a year since. I did not know he was going in; he went in without my authority. I told him to raise the flags, and I would go myself and disinfect it; but when I got there he had been in the cesspit.

245. In cases of that kind you think that those places may be so poisonous as to be dangerous to health?—Yes, where the gases are confined.

246. (*Professor Way.*) This was a case in which the cesspool was a close one?—Yes, at the house of a gentleman, Mr. Smith, a solicitor.

247. Did you hear Mr. Oakes give his evidence?—Yes.

248. He stated that there had been cases of fever about the town, which he attributed to the river. Are you aware of anything of the kind?—The river smells very bad at times.

249. Has it come within your knowledge that any person has become ill from that cause?—I will not undertake to say so of my own knowledge.

250. Should you have known it if it had occurred do you think?—Yes.

251. (*Chairman.*) In what part of the town has the cholera made its appearance within the last few days?—In the low part of the town, very near the locality I have spoken of, where typhus fever was so bad.

252. What is the name of the place?—Sunderland Yard and Thorne's Lane, near the railway arch.

253. Cholera has broken out now, where typhus has before prevailed, very severely?—Yes, close by there. I may also state that in the West Riding prison there are 1,460 prisoners, 115 officers, and 15 other persons residing, and the excrements are thrown into the cesspools and carried through the drains into the river twice a month. About the 1st and 15th of every month the cesspools are flushed.

254. In what condition is the river at those times?—Awful. Up to a few months past the sewage was let out into the beck—Westgate Beck—when it found its outlet into this running stream, and it had to pass through this locality, where fever has been so bad, and where this person died of cholera. The parties have told me repeatedly that they have been almost poisoned out by the stench.

255. When the flushing of those cesspools takes place?—Yes. There is a great deal of hot water that comes from the mills which runs down this beck, and it aggravates the stench, and causes it to boil up on the top, and it becomes of various colours.

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256. You have the Wakefield prison cesspool matter turned into the river?—Yes, that is really so.

257. (*Mr. Harrison.*) Is that above the waterworks?—Yes, and close by the town.

258. (*Professor Way.*) I suppose such a discharge would be infinitely more than if it were passed day by day into the river?—Yes, much worse.

259. (*Chairman.*) Have you observed any difference in the condition of those ashpits as to the stench, whether they are old or new, and whether they have been three months or 12 months or longer accumulating?—The old ones are the worst.

260. In Wakefield gaol, does not the keeping of the refuse in tanks for the time which has been specified cause it to become putrid and to stink?—Most decidedly.

261. If this refuse were passed away day by day and every day, the stink would not be so powerful?—No.

262. The same quantity would be taken away, but under different conditions?—Yes, and it would not be so disagreeable.

263. It goes down an open ditch, does it not?—It did so, but for about two months past it has been turned into a drain which the local authorities have made.

264. To drain the gaol?—Not expressly for that purpose, but it has that effect; the outlet is the same.

265. (*Professor Way.*) What object is there in allowing it to collect for a fortnight, and then discharging it; is it to economise the water?—I cannot state. I asked that question from some of the officers of the prison, but I did not receive an answer.

266. Is no part of this sewage matter used for manure?—I am told not.

267. (*Chairman.*) Have they ever tried it?—Not that I am aware of; they are about doing so; they are thinking of it.

268. (*Professor Way.*) The object of the tank is not for the sake of collecting the manure to put on land?—It is not.

269. (*Chairman.*) There is a large asylum here?—Yes.

270. How many persons are there in it?—Officers and inmates altogether, 1,320; and the same kind of matter has all to pass through the centre of the town.

271. Is that retained in cesspits or in tanks for a length of time?—I cannot state how long, but the inhabitants along the side of the drain say that the worst stench is perceived about once in every week; it is offensive every day, but on one particular day in the week it is almost unbearable.

272. Has there been any attempt to utilize this refuse?—I am not in the least aware that there has. What is still worse the lunatic asylum is out of the borough, and there they might have made a drain to carry it the other way into the river and below the waterworks' reservoir, which would not have caused this annoyance which has been often complained of as a great nuisance.

273. The refuse now goes into the river above the waterworks?—Yes; it all goes to one outlet.

274. Can you state what number of inmates there are in the workhouse?—There are about 600, I understand, in the workhouse, and I believe they collect the privy matter there.

275. What do they do with the privy matter?—They have a great deal of land, and they make use of it. I am told that that is so. I have a good opportunity of seeing the drainage that comes to our place, and I have never seen any animal matter of this description brought down the drain.

276. How long ago is it since the cholera broke out?—Last Tuesday a person died in the lower part of the town, near Sunderland Yard.

277. How many other cases have occurred since then, if any?—None; there was only that one case.

278. (*Mr. Harrison.*) Was the case that occurred imported?—No; he was a man that had been working here for about two years, and a very steady man, of very regular habits.

279. (*Professor Way.*) If you were asked to point out the sources of pollution of the river Calder, at which would you begin if you began at the worst?—I would alter the outlet altogether.

280. I am speaking of the sources of pollution; which is the greatest, the sewage, or the refuse from the manufactures?—They are all very bad. I cannot say which is the worst. In the town I should say the prison is the worst, but the manufactories cause a deal of pollution as well.

281. The river receives sewage above the town?—There is more comes from above than is sent out from the town. When I was a boy, and before the waterworks were established, the river water was used by brewers and for domestic purposes generally. It was carted about in water-barrels; they sold it from 8*d.* to 10*d.* a barrel. My own mother brewed with it, and used it generally for domestic purposes.

282. Is it used for domestic purposes now?—No, it cannot be, it is so very bad.

The witness withdrew.

Mr. W. S. Wade.

Mr. William Swift Wade (of Wakefield) examined.

283. (*Chairman.*) Are you in practice in Wakefield?—Yes, as a general practitioner. I am a licentiate of the College of Physicians of Edinburgh. I practise generally both in surgery and medicine. I am Medical Officer of Health for the borough of Wakefield.

284. How long have you been in practice in Wakefield?—Between four and five years.

285. Have you seen much typhus fever in that time?—I have not seen a great deal as compared with other towns. We have had typhoid, but there has been no typhus here since 1849.

286. Have you found extra prevalence of disease in the neighbourhood of polluted streams, sewers, and foul ashpits?—I have.

287. Have you had reason to think that these have in any way intensified the disease?—I can mention one particular case that happened a few weeks ago,—the case of a woman I was called to. She lived in a yard called Wood's Yard, in Providence Street. Above 200 people live there. There are only two privies for all of them, and one midden in the centre between the two privies. The steps leading to her house were immediately over that midden and over one of the privies, so that any stench from those places would be likely to go into her door. She died in about eight days.

288. Is that same house occupied now?—I cannot say, but I think it is probable.

289. Have you any authority as medical officer to direct that house to be closed as unfit for human habitation?—I do not think I have, at least not to enforce such a direction.

290. Have you directed any house to be closed since you have been medical officer?—Yes; at least one house has been closed by the inspector of nuisances where there was a case of typhoid fever.

291. (*Mr. Harrison.*) I presume you report a case of the kind you have mentioned?—Yes. I reported the case I alluded to the Town Council.

292. Was any action taken by the Town Council?—Not to my knowledge, beyond cleaning out the midden; it was cleaned out.

293. (*Chairman.*) Have you paid sufficient attention to be able to say whether a full or an empty midden smells the worst?—An empty one. When the night soil has begun to come in it smells the worst, and then the ashes have a neutralizing effect.

294. If it is foul when full you cannot call it cleansing it when you empty it?—Not unless something to disinfect it is applied afterwards.

295. How long have you been acting as medical officer?—Only a few weeks.

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296. You advise the council in case of any outbreak of disease, or when the inspector of nuisances wishes to have your opinion?—Yes. I have also to inspect diseased meat that the inspector of nuisances seizes. He calls me in, and I give evidence before the magistrates.

297. Do you know the general character of the river?—I do.

298. Do you think it ought to be purified, if practicable?—I certainly do; it requires it very much.

299. You probably heard what was stated as to the sewage of the borough, the gaol, and the asylum passing into the river, and you are aware that the water so contaminated is pumped and filtered for domestic supply?—It is; and I think it is very objectionable, both in this and in all other towns, to turn any sewage into a river.

299*a*. You think it ought to be prevented?—Yes, even if the river water is not used for drinking purposes, I think it circulates poison all through the land.

300. Is it your experience that the ash middens are a great nuisance?—It is.

301. You say that in one case you think you traced direct injury to health. Do you think that that is a common case?—Yes, I do.

302. If it was possible to substitute soil pans for privies to take away the soil—every day and every hour, and have dry ashes alone to remove, would not that be an improvement?—Yes; it would cause a great improvement in the health of the inhabitants round about those places. If it could be done without taking the night soil into the river, it would be a still greater advantage. I should recommend the substitution of waterclosets for privies in those crowded neighbourhoods, and I should still more do so if from those waterclosets the matter was not taken into the river for us to drink again.

303. Have you had any experience of the use of waterclosets by the working classes?—No, not in my own experience, but from what I have heard, there is great difficulty in getting them to keep them in a good condition.

304. Should you be surprised to hear that all over the poorer districts of London privies for the most part have been abolished and soil pans substituted?—I am aware that that is the case, and I believe it acts well too.

305. If 500,000 people use an apparatus of that kind, I suppose it may be fairly assumed that 5,000 might be taught to use it?—I think so.

306. (*Mr. Harrison.*) Have you examined the water that is at present supplied to the town?—I have not analysed it chemically.

307. Have you traced any illness to the use of that water?—I have not positively traced it, but I have often thought illness was caused by the use of the water.

308. Do you think that the water which is supplied to the town is in a proper condition for the health of the inhabitants?—It has been better recently, since they adopted the system of chemically filtering it. I thought a good many cases of diarrhœa and low fever were probably caused by the use of the water, but it is now very much better.

309. Do you think that if the river were restored to the condition in which it was in 1830 or thereabouts, it would be a proper source for the supply of the town?—I am not aware what the state of it was in 1830.

310. We have it in evidence that it was then in a comparatively pure state, and that fish were abundant?—I should think that a river where fish would live could not be very bad water for the domestic use of a town.

311. (*Professor Way.*) Apart from your knowledge of the source from which the water is at present supplied, which you know to be below the outfall of the sewers and so on, have you any reason to believe from any knowledge of the health of the people, that the character of the water supply has a prejudicial effect upon their health?—Not now; I think that there has been a very marked improvement.

312. You, as a matter of course, object to be supplied with water which has been once so fouled?—Decidedly so.

313. But leaving that knowledge and information apart, have you any reason to believe from the appearance of the water, and from the use of the water since the carbide has been employed, that it is a water which may not be safely used?—I think that the water is very materially improved. From my own knowledge I would not say that it is detrimental now.

314. Is it a water which you would have thought was decent water for use?—Yes, I think that it is.

315. Have you any other reason than your knowledge of the source, for objecting to the water?—I have not. I drink it myself, and I have the means of getting other water with a little trouble to my servants.

The witness withdrew.

Mr. W. Teall.

Mr. William Teall (Wakefield) examined.

316. (*Chairman.*) Are you connected with any of the local manufactures near Wakefield?—I am connected with the iron trade here, and also with the manufacture of candle material and oil from the waste greasy water of woollen and other fabrics.

317. How long have you known this district of Yorkshire?—All my life.

318. Do you remember the condition of the rivers in your early days?—I remember this river being full of fish. I have caught trout at the foot of Wakefield dam, when I was a lad.

319. What does the pollution now consist of above Wakefield, so far as your knowledge extends?—I should say that it arises from the refuse waters of the dye works, and woollen and other manufactories.

320. Do any of the manufactories tip their ashes into the stream?—To some small extent, but I have not much knowledge of that.

321. When did the pollution begin to take place, so as to be visible to the extent that it now is?—Perhaps 20 years ago.

322. Was it with the extension of the woollen manufacture?—Yes.

323. What special part of the woollen manufacture causes most pollution, the washing of the wool or the dressing of it, or the dying of it, or what?—Both washing the wool and dyeing, and also the fulling process.

324. I assume that the whole of the refuse matter used to go into the river some years ago?—The whole of it, I believe so.

325. At what date was this method commenced of extracting the refuse soap and oil from the water after wool washing?—I do not know; but it was carried on upon a small scale some years before I had anything to do with it, or knew anything about it. I have been connected with it some 14 years.

326. Then some persons may have carried it on for 20 years?—They have, upon a very small scale.

327. Does that process tend to the reduction of the impurity poured into the river?—Considerably.

328. Have you had experience in any other form of purification of the water, or recovering waste matter?—None, except in the recovering of indigo.

329. (*Professor Way.*) You are engaged in separating the oily parts of the waste water?—Yes.

330. Is that oil produced from the washing of the wool?—After the wool has been washed we collect the suds and water direct into tanks which we employ for the purpose. The moment a tank is filled we operate upon the contents with chemicals, which separate the thick or dirty stuff from the water. The great bulk is a

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sediment which falls to the bottom; some portion flows on the surface. We run the water off between the top and the bottom, until the greasy matter, which floats on the top part, drops upon the lower part, the water which we turn away into the stream is then comparatively clear.

331. In that residue at the top and at the bottom you obtain a quantity of grease?—Yes, we put it into filters; we again take a further quantity of water from it, which is remarkably clear.

332. How do you get that?—By putting the stuff into loose filters, made of cocoa-nut fibre cloth, lined with a coarse kind of canvas.

333. The liquid drains?—Yes. The whole stuff is a sort of mud in appearance, the water flows and dries out; we then put it into a press with canvas bags, and operate upon it with pressure and steam. The grease runs out into a receiver along with some portions of dirt; this grease we afterwards clarify, and we bring it from all the manufactories in that state to Wakefield.

334. The process is done in the manufactory itself?—In some places it is done by separate men, where the manufactory is sufficient for that purpose; in other places we group several manufactories together by a pipe, through which the refuse water runs.

335. Do you work under a patent?—Yes.

336. What are those chemicals?—Sulphuric or muriatic acid. I took out a patent some few years ago, previously to which the process of recovering the grease was rather a lengthy one, but I found out some years ago that if you heated the suds to about 170 or 180 degrees Fahrenheit, whilst you added your acid, the separation took place a great deal more quickly, and the consequence is now that in 24 hours the grease may be in the soap chest, and finished in the cask.

337. Do you continue the heat afterwards?—No.

338. Is that an expensive operation?—It is rather expensive.

339. In the course of this operation is there any considerable smell of any kind?—No. There is a little smell while the acid is being added, but none in the process. The suds have had no time to effervesce or smell, they are so fresh.

340. When you speak of this as wool-washing, is the bulk of the liquid very large; does it require large tanks?—Pretty large; we merely have an additional number of tanks.

341. But they are not of such a size as would embarrass the manufacturer?—No, we have merely had them made of 3-inch deal about 12 feet by 6 feet, and 4 feet deep, holding about 10 tons.

342. In a large wool-washing place will there be many of these tanks?—Yes; in some cases we build them with stone in the ground, cover them over, and make the surface available for other purposes.

343. The residue having been brought home to your works, you convert this greasy matter into various kinds of oil?—Into stearine for candles and into cloth oil.

344. Is there anything besides the grease which is separated by this action?—Yes, the residuum which is left in the bags after heat and pressure, after we have got all the greasy matter which we can out of it. This is sold by us to manure makers, who use it along with other materials; it is said to be valuable for manure.

345. Does it form an important item in the pecuniary profits?—Yes.

346. Does the manufacturer himself get any advantage by so treating his water?—A very great one in some instances.

347. Do you pay a royalty?—We pay in a variety of ways; one mode, and perhaps the most satisfactory one for all parties is this, namely, for us to pay a certain price per ton upon the finished grease. We take the manufacturer's suds, he supplies us with steam, or sometimes we put up our own boilers, as the case may be. It is simply a question of price between us. We take all his soapy waters, and he receives so much per ton upon the finished grease.

348. It is not finished till you get it home, is it?—It is finished in a certain sense; it is used again by the manufacturers themselves very frequently; it is also used for soap making, and for many other purposes in that state.

349. It is an advantage to the manufacturer to allow you to step in and deal with his soapsuds in this way?—Undoubtedly. We pay one manufacturer 900*l.* a year for his soapy waters, and he finds nothing but those waste soapy waters.

350. What proportion does that bear to the value of the soap employed?—I could not state that, for this reason, it varies considerably, because in addition to the soap which is used, a great deal of oil is used in combing.

351. The liquid which runs away you say is by no means so objectionable in appearance as the soapy liquids would have been if they had gone direct into the river?—No; with proper care it is quite clear that it must be so; if it is not so, there is some carelessness on the part of the workmen.

352. In how many manufactories are you engaged in connexion with this process?—I think that we have about 120 establishments.

353. Spread over different parts?—All over the West Riding manufacturing districts, and also as far south as Leicester.

354. Still there are a great number, I suppose, which are not adopting that process?—No doubt; particularly the smaller manufactories.

355. Where probably it is not worth your while to collect it?—Just so; of course we take the best places first; there are hundreds of places not yet touched.

356. Would it be worth the while of the smaller manufacturers to collect their soapsuds in this way?—In some cases I think not; in some places I do not think that we could afford to pay them.

357. Could they do it for themselves?—I think not all.

358. They could only do it through the instrumentality of a firm like yours?—I think manufacturers could not do it so as to make it pay except their works were on a large scale.

359. (*Chairman.*) Do you say that there are hundreds of places in Yorkshire which are not treating their soapsuds at all?—I should think so, taking the outlying places.

360. Any large ones?—Not many large ones.

361. (*Professor Way.*) If the manufacturers could not obtain a profit by recovering the grease from their waters, at what cost could they do it?—In a great many instances it could be done without any cost to them if they would give their suds away. In several of the smaller places if they would make us a present of the soapy water we could get a profit out of it.

362. If they were compelled to keep the soapy waters out of the river, you, or persons in an analogous position to yourself, would step in and relieve them?—I think so, in a great number of cases, but not in all.

363. Probably the proportion of those cases where it would not be worth your while to interfere would be very small?—Very small.

364. And even there, if you were paid for taking away the soap instead of paying for it, or not paying anything it would not cost very much?—Not much.

365. Consequently, in your opinion, it would not be a great hardship to compel all manufacturers to do what some now do willingly?—I think that it might be done.

366. (*Chairman.*) You would not think it a great hardship if all persons who even treat their soapsuds were compelled to bring that treatment up to some ascertainable standard of purity?—I do not think that it would be.

367. And also if all persons who now turn soap refuse into any stream were compelled to have their soapsuds treated (as experience shows they can be

treated), so as to prevent the impurity, whether it would or would not pay them?—Yes.

368. (*Professor Way.*) I suppose that we should not be right if we considered these liquids to be merely soapy water?—No.

369. They are very much more foul and impure than mere soap dissolved in water?—Yes, no doubt of it.

370. I am not speaking of that which runs into the river after your process, but of the water which you take?—Yes, undoubtedly it contains a good deal of other matters.

371. Animal matters from the wool?—Yes. I may also state that by a new patent—a French patent, which we have lately purchased which I believe will become of very general use in England, as it is now in France—a very large quantity of pearlash may be obtained from the wool before it is touched by the scouring process, by merely putting it into cold water. In fact, we have it now in operation in three or four places at Bradford; but I may say that in England it is a far more difficult matter to introduce a new thing than abroad.

372. (*Chairman.*) For what reason?—I cannot state that. In France it was very rapidly introduced. We have operated several times, and found that the unwashed wool, that is to say, wool which has not been washed in the fleece, produces a very large quantity of potash of a very valuable kind.

373. (*Professor Way.*) And therefore the separation of it is very profitable?—Yes; and it is so simple that it is soluble in cold water, and instantaneously. By the wool being merely put into a tub filled with cold water, and allowed to remain for a minute or two, the water drawn off at the bottom contains all that can be got from the wool.

374. That, I suppose, would not have any effect in the subsequent treatment of the wool?—They say that it improves the wool, and that the wool scours better.

375. (*Chairman.*) Is there any Government inspection in this respect that you are aware of?—Not that I am aware of.

376. Do you think that if a Government inspection were established to compel the treatment of these fluids and the treatment of wools so as to preserve these materials which are proved to be valuable, it would be an improvement?—I do not think that it is done generally in France, except in the larger works. I know that in France last year 1200 tons of potash were recovered from unwashed wool, and was sold at from 35*l.* to 40*l.* per ton. That potash was recovered by merely immersing the wool in cold water. It first of all produces an article like porter in appearance, then that is evaporated until it is a sort of thinnish pitch, that is merely calcined and washed, and the potash is completed.

377. (*Professor Way.*) If the wool has not been so treated this potash would be in the soapsuds?—It perhaps would be in the refuse in the bags after pressure; it would go with the water.

378. You say that the liquid which runs away after the process of separating the grease is very much less objectionable?—Undoubtedly.

379. You say that it is a productive process, and that there is no difficulty in carrying it out in small establishments as well as in large ones, except so far as regards the question of profit?—Just so.

380. You have mentioned indigo from the dyeworks—Where indigo is used for pilot cloths, police clothing, and that sort of cloth, we recover a good deal of indigo from this very residuum or manure, after we have extracted the grease.

381. And that makes the process still more advantageous?—Of course.

382. That indigo therefore is prevented from going into the stream?—Yes.

383. In the case of indigo, is the water which flows away from the process equally clear as when indigo is not present?—It is quite clear.

384. It is not coloured from indigo?—Not in the least.

385. The process prevents any indigo from going into the stream?—Yes.

386. Consequently, if we see a stream coloured blue with indigo, we may say that that indigo has come in with the soapsuds, and might have been kept out?—I do not know that we could recover any indigo from a spent vat; at least we have never tried to do so.

387. But you can from the refuse water from the washing of indigo dyed goods?—Although a portion of the indigo will come away with the grease, a very large proportion remains with the cloths. Of course there is a further process after this brown grease is got; the process is distillation and pressure, but that is a very well known process.

388. Is this trade open to the public; have any of your patents expired?—We have no patent as connected with our operations, except the one for adding steam during the process of separating the grease from the soapy waters.

389. (*Chairman.*) Have you any idea what weight or what volume of material per week or per annum in round numbers is now obtained by this treatment of soapsuds?—I do not know.

390. How many tons per annum do you get yourselves?—We obtain about 50 tons per week.

391. Are 50 more tons got by all the trade?—I should think not more.

392. Then you think that about 100 tons per week would be got now?—I should think so.

393. (*Professor Way.*) That is not including the manure?—No; that is the clear fatty matter ready for distillation.

394. (*Chairman.*) About what is it worth a ton?—About 18*l.* We have a better sort, a more oily sort, it may average about 20*l.* a ton; from 18*l.* to 20*l.*

395. Do you think that if the whole of the wool washing were treated in the same way another 100 tons might be added to it?—I should think more.

396. Then there would be upwards of 200 tons a week?—I should think so.

397. And its value would be about 20*l.* a ton?—I will say about 18*l.*

398. Do you think that we might go as far as 250 tons a week?—It is partly guess work with me. I should say 200 tons at all events.

399. That is 4,000*l.* a week which is recoverable?—Yes.

400. And you are conferring that much wealth upon the community, and saving the pollution of the river as well?—Yes.

401. (*Professor Way.*) That is the value, but that does not represent the profit?—That is both prime cost and profit; that is what the result is worth as a manufactured article. I should say that the manufacturer would receive something like one-third of that amount himself. We pay 5*l.* a ton upon the grease as it comes away, so that the profit is something less than one-third of what I have put as the value.

402. (*Mr. Harrison.*) And the expense to the manufacturer to that point is not large?—He has no expense except finding premises and steam in some cases, but that is very trifling.

403. (*Chairman.*) Knowing the woollen manufacture so well as you do, is there any other process, either paying or otherwise, in the course of the manufacture in which you think that the manufacturers might lessen the amount of impurity which they turn away from their works?—I do not know.

404. Are soapsuds injurious otherwise than by discolouring?—I should think so.

405. They very soon putrify?—Yes.

406. (*Professor Way.*) They help other things to putrify?—No doubt.

407. (*Chairman.*) Therefore, soapsuds are a most noxious thing to turn off the premises?—No doubt.

408. Indigo is a mere discoloration to the eye?—I think so, but I am not an authority upon the subject.

409. (*Mr. Harrison.*) What part of the liquid refuse is turned into these tanks of yours?—In the fulling process, practically we do not take all the water, because when the water arrives at a certain

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thinness, we turn it off and do not allow it to run into our tanks. Paying what we do pay for our soapy water, we should have too much to operate upon with our acids and so on, if we allowed it to run in after it arrived at a certain thinness.

410. (*Professor Way.*) You are collectors of soap, and not purifiers of the river?—Just so.

411. (*Chairman.*) Do you think that there would be any injustice in asking the manufacturers to appropriate some of the profit to the further purification of that water, which is not quite rich enough for you to pay for it?—I should think not. I remember the time when they got nothing for those waters; for years we paid a manufacturer about 3,000*l.* for his soapy waters, and previously to that he did not receive a shilling; he however now manufactures his own grease.

412. (*Professor Way.*) Supposing that it was proposed to apply to the land the waste water of a wool dying establishment, would you think it desirable in the first instance to take the grease out of it before you so used it?—I should think so. I do not know that the land could derive any benefit from the grease.

413. Therefore, whatever steps might be taken by the manufacturers to purify the water before going into the stream, the process of separating the grease should be the first step?—Yes.

414. (*Mr. Harrison.*) In the West Riding, generally, machines are used for cleansing the wool in the first instance?—Yes.

415. So that you get all the liquor in that process?—Yes.

416. In indigo dyeing, very little is turned away from the dyers; they do not turn out their vats very frequently?—It appears very blue. A very small proportion of indigo will discolour a very large quantity of water.

417. Do you know whether it would pay to recover the indigo from the dyeing process?—Do you mean from the spent vats?

418. Yes.—I should think not. We tried some of Mr. Holdsworth's here, which we were very much disappointed in. We thought that from the large quantity of indigo wash which they ran away, we should reap a good deal, but we recovered nothing worth our notice.

419. (*Professor Way.*) What is the quantity of indigo which you get?—It is very small, comparatively; perhaps 120 or 130 lbs. per week.

420. Is not indigo worth a good deal of money?—Yes; it varies a good deal.

421. Is it not worth 6*s.* or 7*s.* a pound?—Yes.

422. Do you get so much as that for the recovered indigo?—Yes, in some cases quite that.

423. Is its quality as good as that of indigo which is bought in the market?—The recovered indigo, I think, is worth more than the original indigo.

424. Because it is purer indigo?—Yes.

425. Having gone through chemical processes, which original indigo ought to go through?—Yes.

426. Have you seen or heard of a press called Needham's press, used for the separation of solid matters from liquid?—I have not seen it.

427. It is a press for separating liquids from solids by pumping the mixture into chambers, and then placing it under pressure. Do you think that anything of that kind would be injurious as regards indigo?—I think not. I do not know how by Needham's process you would operate upon the very hot material. The process is a sort of filtration, and the whole body would go through.

428. You mean when the grease was liquid?—Yes; I am speaking of the indigo, being in a liquid state, containing a large quantity of water that is very hot; it is boiled. I do not know how, by any process except by the settling process, you could get the water from it.

429. Is the liquid which you send away from the grease as pure as it might be if it were properly filtered?—I think so. In all cases of water from the cocoa-nut fibre filters it is as clear as crystal. It is far clearer than our Wakefield water.

430. (*Mr. Harrison.*) Is it acid?—It ought not to be so; if so, it is from an excess of acid having been used.

431. (*Professor Way.*) Is there any process by which it may be made still purer, so that you should discharge nothing into the river in a solid state?—I do not think that anything is discharged into the river in a solid state. The question is, whether the excess of acid can be prevented. We are as careful as we can be not to use an excess of acid, because the very article of the cloths in which we fold the mixture up, in order to put it into the presses, is a very important article, and costs us about 2,000*l.* a year.

432. I suppose that there is a large quantity of lime in a state of lime salt discharged into this river?—Yes.

433. May that be a cause that the Wakefield water is harder than it used to be?—I cannot say.

434. Have you ever heard it suggested that that was the case?—No; but I know that since I have been in business as an iron founder, our brass buckets and pumps and other parts of the engine wear far more quickly than they did 30 years ago.

435. You, I suppose, are not the only people who use acids?—No; the dyers use an enormous quantity.

436. (*Mr. Harrison.*) At present you recover the indigo merely from the refuse from the first of the fulling process?—That is all.

437. Do you see your way to removing the remainder of the indigo that is left after the dying process, and after the cleaning process, so as to prevent the fouling of the river?—I do not. It is impossible to dye a piece of cloth without using a surplusage of indigo, that surplus indigo must wash out, and go away with the stream.

438. And you think that if means were taken at every dye works of abstracting the indigo to the extent to which you do, there would still be a sufficient quantity passing into the river to discolour it almost as much as is now the case?—I should think that some might be recovered, but I do not know any means of recovering it to make it pay.

439. With regard to the 900*l.* which you said you pay to one manufacturer alone for the soap suds, is that for the soapsuds from the wool cleaning and also from the fulling?—He does not full; it is simply from his wool washing, and his back washing, and his yarns.

440. Do you know at all what quantity of wool he uses in a year?—I do not, but it is a considerable quantity.

441. (*Chairman.*) Is it wool or alpaca?—Both wools and alpaca.

442. (*Mr. Harrison.*) Do you think that the weight of potash which is obtained from the wool of which you have spoken is sufficient to make it of importance in ordinary sheep washing?—I am not aware; I do not know how it could be collected; sheep are generally washed in a running stream.

443. But it is not unusual to give them a dipping first of all, a good wetting?—You would have too much water; the expense of evaporation would be too great to make it pay; your water would be too weak.

444. You say that the potash in a very short time collects from the wool?—Instantaneously. The first water which ran off might only be at a density of 1,000, and at a density of 900 it would not be worth working; the expense of evaporation, and cooling, and so on, would be too much, but if you continually use the same water it perhaps will come off at 1,100, or 1,130, or 1,140, and when it comes up to 1,100 we consider it sufficient.

445. You may in that way get it up to a sufficient density?—Yes.

446. (*Professor Way.*) In washing the wool, after you have put fresh quantities of wool over and over again into the same liquid, do you increase the

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strength as they do in the alkali works?—That is the proper way, by having a series of tanks. That plan is, no doubt, practicable, but the question is whether it would pay.

447. Does alpaca wool give potash in the same way?—Not much; the unwashed Australian wools seem to yield the most potash. We have not had an opportunity of trying it upon the skins, which we are about to do in the neighbourhood of Leicester in the course of another month or two. The wool upon the skin now is very short, and scarcely worth meddling with, but in the course of another month or two we shall make an experiment upon the skin; we shall put all the skins in a tank, and operate exactly as we do upon the wool, and see what will be the result; if we get much dirt with it we shall have a difficulty, because dirt will give density.

448. It is obvious from the information which you have given us that the separation of grease from the soapsuds is lucrative. What proportion of the total impurity of the river in your opinion is obviated by that process, is it anything appreciable?—I think so.

449. Is it a third, or a tenth, or a twentieth?—I scarcely know how to apportion it.

450. The river still remains very dirty, is that from the want of the process being carried out?—The river would still be very dirty after doing all that I have spoken of, but the process would do a great deal.

451. (*Chairman.*) The river, I suppose, would be impure from sewage?—Yes.

452. And from refuse discharge of every sort?—No doubt of it.

453. (*Professor Way.*) You do not deal with anything like the whole of the manufacturing refuse from wool works for instance?—No, but we deal with a large portion of the whole bulk; we recover more than all the rest put together.

454. After your process had been carried out with the utmost perfection, woollen works would still discharge quantities of refuse?—No doubt.

455. (*Mr. Harrison.*) Are there any of the materials used in dyeing, besides indigo, which are of sufficient value to make them worth recovering?—I do not know. I should think that there is nothing so valuable as indigo.

456. From the other processes than indigo, the vats are much more frequently emptied into the river than they are from indigo?—No doubt.

The witness withdrew.

Mr. J. Fowler.

Mr. James Fowler (Wakefield) examined.

457. (*Chairman.*) You are a surgeon?—Yes. I am one of the surgeons to the hospital and dispensary; I am not the parish surgeon.

458. To what points in this inquiry do you wish to speak?—I should wish to speak specially with reference to the condition of the river and the impurities which it contains, microscopical and otherwise. I cannot speak from memory respecting the microscopical appearances, but I have some papers upon the subject. (*The same was handed in and is printed at the end of the evidence of the witness.*)

459. How long have you been in practice in Wakefield?—I have been in Wakefield about four years. I have been in practice about two years. I was house surgeon to the hospital for nearly two years.

460. Have you seen much fever in Wakefield and the district?—I have.

461. What kind of fever?—Typhoid chiefly. The largest amount of typhoid which I ever saw in Wakefield was during three or four months in which the water was supplied to the town without any process of purification at all, with no filtration.

462. When was that?—It was about two and a half years ago, in 1864.

463. In what part of the town did those cases of typhoid fever occur?—Chiefly in Westgate.

464. Do you think that the fever and the water had any connexion?—I imagine that the water acted from the amount of sewage which it contained. The water was at that time loaded with animal matter, as one could see from microscopical as well as chemical experiments.

465. What did you find?—I found portions of muscular fibre, starch, vegetable epithelium and other constituents of fæces.

466. Did you get any refuse from the soapworks?—None which I could recognize. The things which I could clearly detect I have mentioned, but there were a great many other things which I could not clearly speak to.

467. Have you refuse from coal mines?—Yes.

468. What character would that give to the water?—I should expect some sulphuretted hydrogen, though I don't suppose that coal mines give any large portion of impurity.

469. You have soapworks?—Yes, a large portion of lime enters the water from them.

470. You have the sewage from the West Riding prison?—Yes.

471. That would be sewage in a putrid state?—Yes. I have mentioned in my report the drain from the prison, but the main drain of the prison is underground.

472. What do the Yorkshire Fibre Company manufacture?—A sort of fibre matting, from Chinese grass, a quantity of alkali is used, and it makes the water very impure.

473. (*Professor Way.*) Is that liquid very dark?—Yes.

474. Is it very like coffee?—Yes, it is a sort of tan-coloured liquid.

475. You have been speaking now of the river water?—Yes.

476. And the water supplied to the town before the process of filtration?—Yes; these microscopical and chemical results came from the water as it was supplied to the inhabitants two years ago; the water was suppleid to the inhabitants in exactly the same condition as it was pumped out of the river, except that there had been a partial subsidence.

477. But there was no filtration?—None whatever.

478. Have you examined the water lately?—Yes, and the water is, I believe, as good as it is possible to obtain it from the river. It is now very fair.

479. Have you examined it microscopically lately?—Yes, and I have not been able to detect anything injurious in it.

480. Would mere mechanical filtration have separated all the objectionable matters?—No, I think not, but I have not recognized any microscopical impurities lately.

481. I suppose that the mere mechanical filtration of water would remove all the animalculæ which were of any considerable size?—Yes.

482. But of course they would be liable to be reproduced from the germs of soluble organic impurity which would pass through the filter?—Yes.

483. In the case of this water have you kept the water for any time so as to allow of that development?—No.

484. But at the time when you examined this water it was free from that objection?—Yes, it was free from animalcules and other microscopical impurity.

485. (*Mr. Harrison.*) Have you made any chemical examination?—Not particularly.

486. (*Professor Way.*) You find in the water what you would find in most river waters?—Yes, except that there are larger quantities of some things, there is a much larger quantity of saline matter than you find in general waters; the water is considerably harder than most waters.

487. In this district are you accustomed to soft

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water?—No, it varies. The lake water is moderately soft, and the water from the springs is a great deal harder, and also the water from the wells; but the filtered water from the river is very much harder than any other water in the neighbourhood.

488. Is it harder than the water from the wells?—Yes.

489. You know that Dr. Clarke's scale of hardness is generally used?—Yes.

490. And that London water is 13 or 14 degrees of hardness by that scale?—Yes.

491. Chalk waters being 19?—Yes.

492. Do you know the hardness of their water, as supplied?—I do not know it by Dr. Clarke's scale. I could not at that time lay my hand on Dr. Clarke's paper, and so instead of his test I used an alcoholic solution and pure white soap of a definite specific gravity. I had an ounce of water, and counted the number of drops required to be added to that water. In that way I made the hardness of the Notton water about 7, and the hardness of the Newmiller Dam water about 9, and of most of the wells in the neighbourhood 12 or 14, while the river water was 16; that is entirely an arbitrary scale.

493. Has this water the reputation of being a hard water?—Yes, I am sure that it has.

494. Is it not possible that a Londoner might call this water a soft water whilst you call it a hard one?—Yes.

495. What is your opinion generally of the water now supplied to the town?—That it is a very fair water.

496. You are not aware of any cases of sickness which could be attributed to it?—No.

497. Would it be equally wholesome if it were not filtered?—No, I certainly think that filtration makes a great difference.

498. Would filtration through sand have produced an equal result?—I should think not.

499. You therefore think that the material used is of value?—I think that it is. I cannot speak with absolute certainty. I merely give a conjecture, because I have not examined it chemically.

500. Do you consider the water unobjectionable, so far as you know, in point of health?—I do.

501. Where did you get the sample of water which you examined?—I drew it from a tap in the dispensary.

502. I am speaking of two years ago?—Yes, that was the occasion.

503. Is the tap on a system of constant supply, or is the water supplied through cisterns?—It is on constant supply at present.

504. Was it at that time?—There is a cistern at the dispensary.

505. Is the cistern often cleaned out?—Yes. I cannot say exactly how often, but the water which I examined two years ago did not go into the tank at all, but came by a direct pipe from the mains of the waterworks. It is a notorious fact that the water was so muddy that it was not fit even for ordinary washing, and that it was not fit for use in any way.

506. Was that at the time when the water was simply pumped up into the town?—Yes, I presume that it was never intended that that water should be drunk.

507. What other supply was there?—There were a few wells. Those who wanted water paid for it. I know many families who used to buy water at that time; private filters were used.

508. The upshot of your view is that the water has been very bad, and now is not bad?—It is very much improved. I can only give my opinion of its condition as a medical man, and not as a chemist.

509. In principle you would not advocate the use of water which had been so fouled as this water has been?—Certainly not.

510. No matter what process had been adopted?—No matter what process had been adopted with it.

511. You would rather have water which had never been foul?—Certainly. I can conceive it possible and probable that infection would be conveyed by this water; that if any infectious discharges entered the water, infectious diseases, such as cholera, might be propagated by it.

512. It has been said that the virus of cholera can be introduced by water from the excrements of cholera patients?—Precisely.

513. Supposing that you had cholera very rife in this town, is there any reason why the water being drunk, part of which had been the water of cholera patients, should produce cholera again?—I should think that it would, even after filtration, though I cannot say so absolutely.

514. You would not like to trust it?—Not on any account.

515. (*Mr. Harrison.*) Two years ago you say you found in the water matter not in solution?—Partly also in solution; the water I believe was loaded with organic matter in solution.

516. You found a mechanical suspension in the water which you could examine carefully with the microscope, such as you do not find in the water now?—Precisely.

517. And the removal of this matter you attribute to the process of filtration which has been carried on?—Precisely.

518. But you did not chemically examine the water then, nor have you done so now?—The water contained a large quantity of organic matter in a state of solution at that time, but it does not contain anything like the same quantity now, in fact I think that it contains hardly any animal organic matter in solution now, but I cannot speak upon that point with certainty.

519. (*Professor Way.*) Have you observed the water before and after filtration; I mean the water going into the filtering tanks and going out of the filtering tanks?—Yes.

520. Is there much difference between the two?—Yes.

521. Is there less organic matter after filtration?—The only means of discovering organic matter which I have adopted is by a solution of per-manganate of potash. If I take two tumblers, one with distilled water and another with another kind of water, I am able to compare the two. If one turns brown immediately, I say that it contains a great quantity of organic matter.

522. Might not this be produced by sulphuretted hydrogen which this water contains largely, and which has the same power of discolouration as per-manganate?—Precisely; but the particular specimen of water which I examined did not contain sulphuretted hydrogen.

523. Admitting that the water now supplied is vastly better than it was before, or than it would be without filtration, do you consider that the improvement is due to the particular filtering medium, or that the process is a mere mechanical contrivance?—I really cannot speak to that.

524. Have you any reason to think that the health of the population of Wakefield is directly affected by the condition of the Calder?—I do not think that at the present moment it is directly affected by the water.

525. I am not speaking of its being affected by the water which is drunk, but of the fact of the water, at certain seasons of the year producing effluvia?—That is an extremely difficult question to answer. I do not think that there is any doubt of the public health being affected indirectly. 20 years ago there was no cod liver oil or quinine used; blistering, bleeding, and purging were the practice at the dispensary, and patients throve upon it; but so far from that they would die under it now, and 2,700 patients require not less than 23 gallons of cod liver oil and 64 ounces of quinine, to say nothing of stimulants and extra diet.

526. In the last 10, 15, or 20 years, as far as you can learn, has the gradual increase in the quantity of quinine employed been in any sort of relation to the want of purity of the river?—I think that the want of purity of the river is one of many elements which cause quinine and cod liver oil to be used. The

want of cleanliness in the atmosphere and in the river, I take it, is the chief reason why so much cod liver oil and quinine are used.

527. There is a general deterioration of the public health?—Yes, consequent upon the want of proper ventilation and of proper drinking water.

528. Quinine being a specific in cases of low fever?—Yes, and in many other cases besides fever. The amount of quinine which is used is, I believe, very large.

529. Does it increase year by year?—Yes, in proportion to our number of patients, which increases also.

530. (*Chairman.*) Then you are somewhat in this condition, that formerly bad doctors could not kill, and now good doctors cannot cure?—I am afraid that it is so in a great many instances. I think that when there was a good wholesome river, and a pure atmosphere, people had no difficulty in keeping alive, but now they have a very great difficulty.

531. I suppose that if we were all teetotalers we should lay the mortality all upon the great additional quantity of beer and spirits which are now drunk?—I do not blame the river exclusively, but I cannot resist the conviction that it exercises a very important influence, with other causes; that it is one of many causes which are at work in deteriorating the health of the population.

532. Have you examined the state of the ash-middens of Wakefield in the crowded part of the town where fever exists?—Yes, but not recently.

533. Have they made themselves at any time evident to you?—Yes, I have frequently complained of them.

534. Is it your opinion that the fermentation of an ashpit, within a few feet of a patient, may have a much more injurious effect than a river, which is many yards distant?—I should think that it would have.

535. That the ashpit would be the worst?—Yes, certainly.

536. Then do you not think that the habit of retaining filth near to dwellings might be blamed as well as the river?—Very likely, so far as regards producing a great nuisance in Wakefield.

537. We have it in evidence that 9,000 two-horse loads of ashes and privy refuse are removed from Wakefield in the course of the year, which have been formed here. Do you not think that the piling up of that quantity of night-soil (which gives off gases known to be deadly in their effects) may produce a contamination of the atmosphere very much worse than any which the river can exercise?—I think so; it makes it so much worse for the ashpits, but not better for the river.

538. Certainly not, but when we are looking for causes for deterioration we may as well look to all the causes?—Certainly.

539. Do you think that the smoke, which is now very much greater than it was 30 or 40 years ago, may have a very prejudicial effect upon the inhabitants?—I think that it has.

540. (*Professor Way.*) Which of the two alternatives would you choose, that the solid and liquid matter voided by men and women should remain in the cesspits in the neighbourhood of the houses, or should be discharged into the river?—I should choose that it should be discharged into the river.

541. It would be better to put up with a foul river receiving the sewage of a town, than that that town should not be sewered at all?—I think so; but I would rather not give an opinion as to which is the better of two things, both of which I look upon as so injurious.

542. (*Chairman.*) Have you ever yourself made so close an inspection of districts having a foul river running through them, compared with districts free from river influence but having cesspools only, as to draw a conclusion as to which was the greatest evil?—I never have.

543. Then would you be surprised to hear, that when such an examination has been made, the river has been found a very innocent offender as compared with the cesspools?—I should expect that the river would be a less offender than the cesspools.

The witness withdrew.

REPORT by James Fowler, Esq., Surgeon, on the conditions of the Calder and its tributaries in the Wakefield district. (Referred to supra, Question 458.)

It would be difficult to find a more striking instance than that afforded by this part of the Calder, of the extent to which our Rivers have been defiled by sewage and refuse from manufactories. Its green banks and interesting scenery made it formerly a pleasing resort for the artizan and operative in hours of leisure, while its clear and sparkling waters invited the healthful recreations of boating, bathing, and fishing. Even so lately as within the last twenty years, anyone with a fly might in an afternoon catch a basketful of chub, each weighing at least two or three pounds; and during freshes, with a cast net, very frequently ninety or a hundred, sometimes even a hundred and fifty pounds of roach, chub, gudgeon, &c. were caught in an evening. On one occasion, where the water was let off from a quite short cutting belonging to the Calder and Hebble Navigation Company, at least four hundred and fifty pounds of eels were taken; in fact, whenever anyone wanted fish, a sackful might readily be obtained. Nothing of this kind has been known, however, since the springing up of manufactories in the vale of the Calder. Nearer home, soon after the Thornes Soap Works were begun, many stones of fish, which had come up the river to spawn, were to be seen floating dead upon the surface. During that year all fish forsook the stream as regular inhabitants. For some time after, however, during freshes, a fish was occasionally to be seen as a curiosity; and so lately as 1858 an experienced fisherman succeeded on one of several persevering trials, in capturing two small chub.

At present, the condition of the River is most disgusting. Defiled almost from its source, it reaches us with the accumulated refuse of Todmorden, Hebden Bridge, Sowerby Bridge, Halifax, Elland, Brighouse, Cooper Bridge, Holmfirth, Huddersfield, Mirfield, Dewsbury, Earlsheaton, and Horbury. At the suspension bridge about a mile and a half above Wakefield it runs slowly and in many places is almost stagnant. It has a bluish-black, dirty slate colour; and a faint, urinous smell which leaves an extremely unpleasant impression for hours after it has been once thoroughly perceived,—considerably worse than that made by the Thames after a stage on a penny boat. The banks and every twig and weed in reach, are coated with soft black slime or mud, studied on the edges of the stream with vivid crimson patches of annelides. Above are overhanging willows; and where the branches of these touch the water, especially in any quiet pool, large sheets of thin bluish or yellowish green scum collects, undisturbed save by the rising to the surface of bubbles of fœtid gas. Between this point and Wakefield, the refuse of extensive soap works and worsted mills enters, causing discolouration for several hundred yards. I have, in fact, traced large quantities of soap-scum beyond Porto-vello, a distance of about half a mile. Nearer the town, quantities of refuse from extensive dye works are continually being discharged, to say nothing of the periodical emptying of spent liquor and vat sediments. On the opposite side are two full streams, one of sewage, the other apparently from some cotton mills; and here it may be stated that the exact degree to which influxes of this kind injure in different cases is extremely difficult to estimate; some manufactures using ammonia, while others adhere to the old fashioned pigs' dung and urine. The banks on each side are here studded with granaries and malting-houses, from the latter of which are received that most pernicious contamination, the steep-liquor of malt. There is also the refuse of at least one brewhouse and piggery, and of a second soap manufactory drained into the River before it reaches the outlet of Ings beck, at the dam immediately above Wakefield Bridge. In this situation, on any warm day in summer, torrents of gas may be seen rising to the surface, and every now and then large masses of mud, which float for a while, and then, after the gas they contain has escaped and polluted the atmosphere, break up and are redeposited, or they are at once carried down the River, stinking and putrefying in their course. The Calder and Hebble Navigation Company are periodically put to great inconvenience and expense in removing collections of this kind. About two

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years ago the mud had accumulated to a depth of 5 feet, and the water having been drained off, at least 2,000 tons were removed, but not one fish or living being of any kind was discovered. On the bridge, a water-mill has been for at least 700 years, and no one interested in the smell of partially oxidized sewage should omit to stand over the spray which ascends from the wheel. Masses of solid fæces may be seen at the grating through which the water is strained. Looking from the bridge westward, except in wet weather, is a large, open, shallow, almost stagnant pond of the most offensive character, with tracts of dark coloured mud constantly exposed. The sewer of the town with the refuse of the malt kilns, breweries, dyeworks, worsted, woollen and cloth mills, fibre mills, soap mills and grease works, enters by the main drain just below; its surface coated with froth of every conceivable colour and degree of filthiness, overhung by willows, in whose branches are entangled and exposed to view the most disgusting objects. The scum may readily be traced down the River for a considerable distance. The last defilement of moment is that from some extensive grease works, in which oil of vitriol is largely employed.

The Ing beck, to which I have already alluded, merits a few particular remarks, being the more important tributary the Calder receives in this district. On the day I last examined its outlet, the smell arising was most offensive. The general resemblance of the stream was rather to soup than water, and it had a dirty, greasy, yellowish, indigo-slate colour, where not coated by froth, scum, or floating filth. Its bed is silted to a considerable extent by black, fœtid mud, and its outlet partially obstructed by two large ash-heaps. It may be observed, however, that this is perhaps the only place in the neighbourhood at present where refuse ashes have been tilted, and that, though the height of the water in the River alters very considerably according to the state of the weather, the bed is not permanently raised much by solid refuse from manufactories, and that consequently we are not liable to innundations. Walking up the bank of the beck, one may form a fair idea of the kind of contamination which it receives. Besides dead dogs, tin kettles, old pans, boots, hats, &c., we find house-sinks, and surface drains, public-house refuse and factors' privies flowing in unscrupulously. Myriads of annelides in the mud on the banks subsist on the impurities; that in the neighbourhood of a warm sewer being, in fact, for some distance entirely concealed by sheets of moving pink. A railway waggon maker's establishment was a little while ago an artificial manure factory, and contributed greatly to the general pollution.

At the bottom of Thornhill Street are two strong foul streams, one of sewage, the other, on the day I visited it discharging deep indigo coloured stuff. Immediately above this the beck, though receiving muddy refuse from some cement works, was purple coloured, and where the branches of overhanging shrubs dipped beneath its surface, a polychrome froth and scum collected. A few hundred yards higher, having passed the place of entrance of the purple dye, the stream regained nearly its original indigo appearance. Near the Lawe Hill bridge was a dirty fall of hot mauve refuse, with several yards of rainbow-coloured scum. Where the water could be seen in one light it would have a bluish tint, in another a dirty yellowish; and the mud was very deep and flocculent. Nearer Chald Lane there was an extremely filthy ditch loaded with the privy and house refuse of a large number of cottages and low lodging-houses and two large streams of thick purple dye refuse. Above the dam in this situation enter the waste of a dye-works and shoddy mill, with the filthy privy and surface drains of Salt Pie Alley. The water here is the colour of the contents of a slop-pail, is almost stagnant, coated in patches, each of several yards, with scum, and is in other respects very offensive. At Brooksbank a kind of long oblong pond is formed, two sides of which are of thick mud, one exposing the privy refuse and excrements in three drains from the neighbouring cottages and lodging-houses. Balne beck also enters at this point. Going onward it receives the fouled water and other refuse of two large worsted mills, of surface drains, piggeries, and privies; then muddy water, apparently from some brick yards, and hot waste from a large woollen mill. Immediately above, however, the water becomes clearer and less coloured; healthy green confervæ begin to show themselves; long grass floats on the surface; shrubs grow up on the banks; and if a brown scum collects where the branches touch the surface, it has altogether a less disgusting character. Fairly out in the country the water is clean and sweet, and boys bathe in it in summer when deep enough.

Balne beck is on the whole as yet tolerably clean, the sides only being lined with mud, patched with red, and the stones at the bottom coated with long trails of green confervæ. The principal impurities are from a soapworks, a coal-mine, a skin-preparing shed, a brick-field, and the West Riding Prison. The Yorkshire Fibre Company did a short time since drain a large quantity of poisonous matter into the beck, but is at present restrained by an injunction.

The Water Company's Works are situated about two and a half miles from Wakefield Bridge, and consequently receive the water in an extremely unfavourable condition. I have not any recent minute observations by me, but the following is a tabular statement of the result of a lengthened microscopical and chemical examination of the water during the summer of 1864:

- Animal
  - Living
    - *Protozoa:* Monas, Uvella, Vibrio, Arucha, Actinophrys, Spiculæ of fresh-water Sponge. The last from the Barnsley Canal.
    - *Rotifera:* Rotifer, two species.
    - *Infusoria:* Vorticella, Coleps, Paramecium.
    - *Annelida:* two species.
    - *Entomostiaca:* Cyclops, Daphnia.
  - Dead
    - *Muscular fibre,* altered and decaying; from sewage.
    - *Phosphates, Nitrates, Sulphur, and Ammonia;* from sewage.
    - *Organic matter in solution;* from sewage.
- Vegetable
  - Living
    - *Fungi:* two microscopic species.
    - *Diatoniaceæ:* Fragillaria, Asterionella, Nitzschia Surivella: from the Barnsley Canal.
    - *Desmidiaceæ;* Staurastrum, Navicula, from the Barnsley Canal.
    - *Confervæ:* two or three species.
  - Dead
    - *Starch,* from sewage.
    - *Vegetable Epidermis and decaying tissue,* from sewage.
    - *Sporules.*
- Mineral
  - *Chlorides,* and *Sulphates* of *Lime, Magnesia, Soda,* and *Potash.*
  - Diffused *Silica* and *Alumina.*

On stirring up the mud from the bottom a Winchester quart of gas was readily collected by means of an inverted funnel, and was found, on examination to consist chiefly of carbonic acid, light carburetted hydrogen, sulpuretted hydrogen, and free nitrogen.

It is not easy to estimate accurately the effect of nuisances of this kind on the public health. Two years and a half ago, whilst the waterworks were undergoing improvements, and for some months the supply to the town was merely pumped up from the River into the mains without filtration the actual mortality was not increased. Still, as I had occasion to represent to the Local Board at that time, there was a greater amount of diarrhœa, continued fever, erysipelas, diffuse abscess, and of cutaneous and subcutaneous cellular inflammation; while the inflammation generally was peculiarly liable to take on the erysipelatous form and become unmanagable, and the convalescence from various diseases to be unwontedly interrupted and prolonged. Possibly this, and even an increased death rate had it occurred, might have been explained in part by other causes; but I cannot resist the conviction that bad water as a beverage, and the taint which it communicates to the atmosphere, bear a most important part both in causing actual disease and in weakening the power of the constitution to bear up against disease, and so shorten life in that way. Greatly improved houses have been built for the artizan class during the last few years; greater attention has been paid to the ventilation of mills and workshops; the agitation for a people's park indicates how wide awake the population is to the benefit of fresh air; wages have increased; the character of the food consumed is more closely inspected; the drainage is more efficient; many open sewers have been closed; bad wells have been stopped; but both the death rate and the amount of disease have increased. An indication of the extent to which constitutional vigour has at the same time diminished, is found in the fact that less than 20 years ago to blister, bleed, and purge was the routine of the physician's practice at the dispensary, while cod-liver oil and quinine were unknown. This mode of treatment, if it did not cure, certainly did not kill; for the patients did well under it, having strength to bear up against and conquer both disease and treatment. Now, I will venture to say, that 99 per cent. of our patients would sink under the depletory measures of by-gone days, and I may add that during last year, in a practice of only 2,700 it was found necessary to prescribe no less than 23 gallons of cod-liver oil, and 64 ounces of quinine, to say nothing of nourishment and stimulants.

(Signed) JAMES FOWLER,
Surgeon.

Wakefield,
15 Oct. 1866.

SAMUEL HOLDSWORTH, Esq., M.D. (Wakefield), examined.

544. (*Chairman.*) You are an alderman of this borough?—Yes.

545. You have heard the evidence which Mr. Fowler has just given?—Yes, I have heard the whole of the evidence.

546. Do you agree generally with the evidence which Mr. Fowler has given, relative to the causes of disease, and the fouling of the river?—I do.

547. How long have you known this district?—Since my birth; I am a native of Wakefield.

548. In your boyhood was the river any purer than it is now?—There were fish in it at that time. I used to catch fish.

549. What kind of fish?—Eels and perch and chub, and dace occasionally.

550. Do you think that there are any fish in it now?—No.

551. You have not had fish for many years?—Not perhaps for 12 years.

552. Have you been in practice as a physician during the time that you have resided here?—Yes, since 1847 or 1848, about twenty years now; I commenced practice here sooner, but I had to leave Wakefield on account of health, so that my practice extends I may say over nearly 30 years.

553. Have you witnessed any alteration in the types of disease during that period, so peculiar as to impress itself upon you?—Very much so.

554. What changes have taken place?—Formerly it was the universal practice to use the lancet and cupping, and blood letting, but now the lancet rusts, and the leeches die for want of being used, and the cupping glasses are laid aside—from years end to years end—I do not suppose that the cupping glasses are used at the dispensary.

555. Is that from an improvement in the art of surgery or from a deterioration in the patients, so that you do not dare subject them to that treatment?—I presume that it arises from a different type of disease from what we had 30 years ago.

556. Do you suppose that that state of things is general?—I believe that it more or less pervades extensive manufacturing districts, but I do not think that there is, in the rural districts, any very great difference compared with the state of things 30 years ago.

557. Are bleeding and cupping resorted to in the rural districts?—Not to the same extent as formerly. Certain influence has been at work for many years, which doubtless has reached the medical profession in the agricultural districts, but I certainly consider that the type of disease in manufacturing towns is very much changed.

558. Is it not a fact known in your profession that diseases run a course like the course of an epidemic, begin and become as it were rampant and expend their fury and partially die out?— Yes, we have epidemics of influenza.

559. But is not that the case with special types of disease?—I am aware that gaol fever has disappeared, but we have typhus fever in its various forms which is allied to gaol fever.

560. Have you at all made yourself acquainted with the mode of disposal of sewage in this town, or the retention of refuse in ashpits?—My knowledge is general upon the subject.

561. Have you heard that at the West Riding prison the refuse of 1,460 persons is passed into tanks till it becomes putrid, and is then at intervals passed down certain drains into the river?—Yes; the cesspool is flushed at intervals such as once a fortnight.

562. Do you think that that is likely to be injurious? Yes, I think highly so.

563. And the same may be said of the asylum?—Yes, exactly the same. We unfortunately receive the whole refuse of the West Riding asylum through Wakefield, and up to this summer the refuse discharged from the asylum has passed down for a considerable course in an open drain. This open drain has been supposed to have to do with sickness in that locality. During the past summer it has been covered over by an arrangement between the magistrates and the corporation, but so far as the river is concerned the whole refuse from the asylum still finds its way through the town into the river. Why the magistrates do not retain it and manure the land with it I do not know. I have often wondered that they had not a system of tanks by which at any rate they might have collected some of the sedimentary refuse, and have used it, as they have a considerable extent of arable land.

564. I suppose that the pollution of the river has grown up with the increase of population?—Yes.

565. Do you know the character of the water which is supplied to Wakefield for drinking purposes?—Yes.

566. Do you use it?—Fortunately I do not, nor my family.

567. Why do you say "fortunately"?—I always feel that great risks are run by drinking it.

568. Have you known in your practice any evil effects caused by persons drinking it?—Not directly.

569. Have you had any complaints in your practice from persons drinking it?—Repeatedly, especially during the period detailed by Mr. Fowler two or three years ago; that period during the hot time of the year, and at that time the supply was irregular, though perhaps not to be called intermittent; but I know that for long periods up at St. John's and the high parts of the town, the supply was very inadequate to the wants.

570. What was the cause of that irregularity?—It was owing to certain alterations going on at the waterworks. It was, of course, a period which was attended with great danger to the health of the inhabitants, but fortunately the water is very much improved now compared with what it was then excepting its hardness.

571. Is it much harder?—My impression, from the quantity of soap used, is, that it is harder than it formerly was.

572. You use it for washing?—Yes, for baths, and for waterclosets.

573. Have you any idea what causes the hardness?—No, I do not know to what to attribute it, unless to the iron used in the process of filtration.

574. (*Professor Way.*) Would the water itself of the river be harder now than it was at the time which you speak of?—I cannot say.

575. Has the corporation at all discussed the question of a better supply for the borough?—Yes, at different times.

576. As we have heard from the deputy town clerk there was, I think, an attempt in 1861 to treat for the works?—Yes.

577. Were you in the council then?—Yes, I took an active part in the endeavour which was made to purchase the works.

578. You are aware that at present the sewage is sent down net into the river. Have you at all considered the question of its utilization or its treatment before going in?—Yes, generally. I have been continually alive to the question, but I am free to confess that I have not myself seen my way out of the difficulty.

579. Have you seen any of the places where sewage is utilized, as at Edinburgh?—No; we had a report from one of our borough surveyors, Mr. Tarbottom, as to the Leicester works, some time ago, but I believe that the works there are all now discontinued.

580. (*Mr. Harrison.*) What was the date of that report?—It would be about 1858. You asked Mr. Fowler as to whether it would be preferable that the night-soil and ashes from the houses should remain near to the houses, or be sent into the river. My opinion would be rather different to his. I should be more disposed to give a decided answer against its going into the river.

581. (*Chairman.*) Would you retain it where it is at present?—Yes, I should endeavour to retain it, but to retain it in such a way as not to be injurious to

WAKEFIELD.

S. Holdsworth, Esq., M.D.

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health, or to reduce that injury to the minimum either by the dry closet system, or by the daily removal of all animal and vegetable refuse from houses, by a constant system of cartage. It has been stated that 9,000 two-horse loads of refuse are yearly carted away from Wakefield. I should not mind if it was double that amount, provided that there was not an intermittent system, but that the system was perpetual, and that the refuse was carried away with such rapidity that it could not become in any way a nuisance to the inhabitants.

582. That it should not set up fermentation ?—Yes.

583. (*Professor Way.*) How could you accomplish that object ?—By the dry system.

584. Do you mean by the use of earth ?—Yes.

585. By Mr. Moule's plan ?—Yes, so far as it could be adopted. That is yet in its infancy. I do not express a decided opinion upon the dry system, but I think that it is desirable to keep as much as possible all animal excrement out of the river.

586. (*Chairman.*) In using the expression "dry system," I suppose you are aware that no operation of that kind would secure absolute dryness, that there is urine to contend with ?—Yes, I have not seen my way out of that, but I would deal with the soil excrement.

587. (*Mr. Harrison.*) And there are the slops of the houses ?—Yes, they must be as they are now.

588. (*Chairman.*) You are aware that with any dry system you must have sewers and drains for the street water and refuse water, and that you must provide houses with this extra apparatus for the dry system, as you call it ?—Yes, by using ashes, and by a different system of building privies, the dry system could be carried out to a very considerable extent.

589. You are aware that with patients, under many conditions, it would be impossible to keep the places clean as you do now by waterclosets, and that the matter would come in contact with the surface, and become putrified, and that if you once set up putridity every atom of refuse which you put in connexion with it would rapidly take the same form of corruption ?—Yes; but I am not wedded to the system, because I do not see how it would deal with the fluid part of the refuse.

590. Taking your own house, or any gentleman's house, you may have two or three waterclosets, and so long as the company supply you with water, and the closet is kept in repair, the process goes on evenly without any intervention of a second party, and certainly without any nuisance from the closet, if properly used, and you and your servants know nothing of it. But if you have what is called the dry system, you must charge your pan with the dry earth ?—Once a week.

591. If the earth gets wet and saturated, how are you to dry it ?—If you name houses of a certain class, I do not suppose that the dry system, from what I have seen of it, is likely to be introduced for some time; but in reference to cottage property, I think it quite possible to have a system by which dry earth may be used. To some extent, dry ashes take the place of dry earth. We have a large number of cottages and close yards, and ill-ventilated yards, in Wakefield, many of them being closed at one end. There could be receptacles into which the refuse might be thrown, and regularly taken away. The matter should be entirely under the control of the authorities, and the owners or tenants of the properties should have nothing to do with the refuse; and in cases of that kind, meaning cottage property, I think that there would be an advantage in carrying away the refuse to the land by boats, or by farmers' carts, over sending it down drains.

592. In Lancashire a company was formed to carry out what is called the Eureka system—the dry system ?—Yes.

593. But they have failed to make it pay ?—Yes. A Local Board of Health would look for a return of profit in the form of improved health to the inhabitants, and therefore would be able to do what private enterprise could not do.

594. (*Mr. Harrison.*) As to any comparison between carrying the sewage into the river and having the present cesspits adjoining the cottages, are they not both of them abominations ?—Yes.

595. And neither of them ought to be allowed to exist ?—No, or only to exist in such a form that they could not be calculated in any way to be objectionable or injurious to health.

596. To what do you attribute the altered nature of the type of diseases in the district ?—It is very difficult to assign it to any one particular cause. How far the increased amount of smoke, and the condition of the water in past years, and other circumstances which I cannot now enumerate, may have had to do with it I am not prepared to say. At one period we undoubtedly suffered, and I think that it is probable that persons were really injured by the effluvia arising from some extensive greaseworks, belonging to Mr. Teall, who has given evidence here this morning, but there is not the same amount of ailment from the deteriorated state of the atmosphere from those works as was the case some years ago.

597. (*Mr. Harrison.*) Are you aware that the sewage of the town of Croydon, is now most beneficially and profitably applied to the land ?—I have understood so, but I have not seen it.

598. Has your surveyor seen it ?—No.

599. Have your corporation taken any steps to make themselves acquainted with that subject ?—I think not, we have not lately had our attention directed to preventing the sewage going into the river—we have been more occupied by sending more sewage into the river, by draining those districts which hitherto were not drained.

600. You are increasing the evil and are taking no steps to remove it ?—Just so.

601. Do you not think it desirable that your corporation should set about doing something of the kind ? — Corporations are generally very sluggish bodies to move.

602. Then you think that a little help from Government would not be amiss ?—It is a question of the amount of interference. Those bodies are generally very tenacious about being interfered with, but I do not know that it might not be well if some more stringent measures were exercised upon representative bodies in towns than at present exist.

603. As a medical man, I apprehend that you object to the system which Wakefield now employs of discharging the sewage into the river a very short distance from the point where they are drawing their water supply ?—Yes.

604. You cannot approve of it ?—No. During more than half the year there is always a very obnoxious smell from the water in the river. It is used to turn the water-wheel of a flour mill at the foot of a bridge going out at the south side of the town, and you can get a scent-bottle in perfection by the friction of the water upon this water-wheel.

605. (*Chairman.*) What is the general health of the miller, and of the men who work about that mill ?—It is to be hoped that they do not get the smell inside. It is received by the inhabitants who pass there.

606. (*Professor Way.*) Is it not generally considered that by sewering a town and getting rid of sewage matter, even into the river, you are advancing a step, though perhaps you are creating another evil, but an evil not of parallel magnitude ?—I do not approve of the system of waterclosets for all classes of houses.

607. You would like a dry system ?—Waterclosets for the working class are continually out of order. Children throw all kinds of things into them, they become obstructed, and then they become a far greater evil than a privy or an ashpit.

608. (*Chairman.*) Do you think that you are justified in using those terms if you have not made yourself acquainted with what has really been done elsewhere ?

If I should tell you of thousands and tens of thousands of waterclosets in existence among the working classes which are not abused (and this is the case), would that be an answer to you?—We have tried them in Wakefield. I have done all I could to prevent the houses for the working classes having waterclosets, when plans have been sent in for buildings. My opinion is that the privy might be used in such a way that all the ashes from the houses might be sent into it, and all the excrement might be removed, so as not to be injurious, even in hot periods of the year. Combined with that system of privies, I would have a system of continual removal.

The witness withdrew.

Adjourned to to-morrow at 11 o'clock.

Wakefield, Wednesday, 17th October 1866.

PRESENT:

ROBERT RAWLINSON, ESQ., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, ESQ. | PROFESSOR JOHN THOMAS WAY.

Mr. EDMUND LYNAM (of Wakefield) examined.

609. (*Chairman.*) How long have you been borough surveyor?—About eight months. I held an appointment at Bradford before.

610. About how much of this town is sewered?—Most of the principal streets in the town are sewered.

611. Have you a plan of the sewers here?—Yes.

612. Have you any idea how many houses are drained?—I do not know the number.

613. Where do the sewers empty their contents?—Into an arm of the River Calder, just below the mill goit.

614. Have you ever noticed the character of the material?—Yes, I have noticed it many times, and the water has very rarely been particularly foul. There has been a great quantity of water coming down, but not much excrements.

615. What class of houses have waterclosets in Wakefield?—Very few; only the better class of houses.

616. Are there either waterclosets or soil-pans in any of the cottages?—I do not know of any.

617. You have not put any up?—Not since I have been here.

618. Where does the sewage of the gaol and asylum and the workhouse find its way to?—The West Riding prison sewage matter is conveyed into the Ing's Road sewer, one of the main sewers, and from thence to the general outlet. There is only one outlet for the sewage.

619. Generally the whole of the sewage of those establishments finds its way to the river?—Yes.

620. Are the sewers fully ventilated?—They are very ill ventilated. I do not know of any sewer that has any ventilation at present.

621. Have you any means of flushing them?—No means are carried out now.

622. Have you man-hole arrangements for examining the sewers?—There are man-holes in all the sewers, but they are at long distances apart.

623. Have they moveable covers, so that you can easily get at them?—The covers are moveable, but we cannot very easily get down.

624. They are not made convenient for examination of the sewers?—Not very convenient; not at all convenient for cleaning out the sewers.

625. Do you employ men to cleanse the sewers by hand?—Yes. I found a great want of cleansing in the sewers, and I have received an order from the Sewerage Committee to get whatever may be necessary for this purpose.

626. Have you had an order this summer?—Within the last month; and I have given instructions to carry out such work.

627. Is it contemplated to complete the sewerage of Wakefield?—It seems to be the expressed wish of the committee to get all the sewers carried out that have been set out on a general scheme which has been presented to the Government.

628. When was that scheme introduced?—Plans were submitted last year.

629. Did any inspector visit the town to examine the plans and report upon them?—Mr. Ranger and Mr. Robert Morgan. Mr. Morgan was, I think, employed by Mr. Ranger subsequently perhaps to complete them.

630. Your plans are therefore very old?—Yes, they are.

631. Have you received any instructions to devise a complete system of sewerage for the whole borough?—No.

632. There is no completed system of sewerage, and you have not as yet apparently devised a completed system.

(*Mr. Morgan.*) We think we have, and that the plans which have been prepared by Mr. Robert Morgan, when amended, are the plans that will be carried out. Those very plans have been to the Home Office, and have been approved of.

633. (*To the witness.*) Do you know what has been the expenditure upon the main sewers? What have you borrowed?—The board have taken powers to borrow 12,500*l.* I think they have already borrowed about 6,000*l.* or 7,000*l.* They have expended about 4,000*l.* or 5,000*l.*, and they are carrying on new works for sewerage, and they have made application to the Home Office for permission to borrow the whole rateable value of the borough.

634. Which is how much?—72,000*l.* I will put in a paper, in which I have taken out the correct rateable value of the property from 1848 to 1866. It shows how the rateable value has increased.

635. You have made up your minds to shut your eyes and act in the dark, and to borrow the whole rateable value?—They would not borrow the whole at once, but as it was required. For all the new sewers we have man-holes.

636. With moveable covers?—For the new work.

637. With proper arrangements for disinfecting the gases, and for ventilation?—In those which we are carrying out now we have those provisions.

638. You are making proper arrangements for flushing?—Yes, we shall do that.

639. Do the Town Council or the Local Board of Health serve notices on owners of property to drain their houses when the sewers have been put in the streets?—We have done so lately; we have given some notices.

640. Are you aware that the Town Council have the power, and that it is their bounden duty, to serve notices on all owners of property, as the main sewers are constructed, to drain their houses, and if they do not do it to drain them for them?—Yes, I am aware that there is such a power.

641. Do you carry it out?—Yes, in those cases wherever it is pointed out to us as being necessary.

642. Where some person points out the state of things as being a nuisance?—Yes.

643. Have you visited any of the places where sewage is applied to land for agricultural purposes?—I have not; I have only read reports upon them.

WAKEFIELD.

Mr. E. Lynam.

17 Oct. 1866.

644. Have you examined the land below your outlet on either side of the river, to see if there was sufficient area to apply your sewage?—Not with that purpose.

645. Have you examined any works where sewage is treated in other ways, where the solid refuse is taken out, and where the water is clarified before it is passed into the river?—No, but I have read a report on some of those matters. They have been lately carrying out such works at Blackburn, and I have had a description of those works from a person who has visited them, but I have not seen any of them.

646. You have not been instructed by the Local Board to make yourself acquainted with any such works?—Not as yet.

647. Are you carrying out the main sewerage now?—Yes; we are carrying out three main sewers at present, one along Thorne's Lane, one along the Stanley and Aberford Roads, and one in Southgate.

648. Are they being done by contract?—The two large ones are being carried out by a contractor, and the small ones we are doing ourselves.

649. Are there any ditches, or foul burns, or channels, within the area of the borough into which adjoining houses pass their refuse?—There are several such places in the borough.

650. In what condition are they in hot weather?—During this summer there have been several complaints made respecting one or two of them, and orders have been given by the committee that they should be cleansed.

651. Would the bad condition of these places be removed by proper sewering?—All those places I think, without exception, will be removed when the present system of sewerage is fully carried out.

652. Have you any further suggestions to offer to the Commissioners?—I have made this remark when I have been down at the outfall of the sewers, and at the outfall of Ing's beck, that the most foul water comes down from the beck, considerably more than comes from the outlet of the sewers.

653. What does that arise from?—I think it arises from the manufacturers being allowed to turn all the refuse, dye water and sud water into the beck, instead of being compelled to put it into the sewers.

654. Which manufacturers are those—can you name them?—There are several manufacturers in Westgate who do so.

655. What do they manufacture?—I believe it is worsted yarn.

656. And soapsuds, and dye refuse water, are turned into the beck?—Yes, generally they are.

657. Is there no sewer there?—Yes there is, but I believe the manufacturers are almost forced to turn it into the beck—having taken the water out from the beck, they have to return it there again.

658. You have stated that the beck is fouler than the sewers?—I think it is considerably fouler.

659. To look at?—Yes, and the water has more effect on the river than our sewers, and for a longer distance, considerably.

660. (*Professor Way.*) That beck in fact acts as a sewer?—Yes, principally as a sewer for the refuse water from the Mills.

661. (*Mr. Harrison.*) Was a plan submitted to the Local Government Act Office last year before you obtained permission to borrow 12,000*l.*?—Yes, it was submitted before the money was borrowed.

662. Where was the outlet shown on the plan?—There was an outlet formed before those plans were submitted.

663. And that outlet was shown on the plans?—Yes.

664. Was it made known to the authorities of the Local Government Act Office that that outlet was at a short distance above the point whence the water is taken for the supply of the town?—I do not know, I am sure.

665. Is there any deposit in the river below the outfall of the sewers?—There does not seem to be a great quantity.

The witness withdrew.

Mr. William Woolass (of Wakefield) examined.

Mr. W. Woolass.

666. (*Chairman.*) What are you?—I am the aqueduct keeper at Stanley Ferry.

667. Over the Calder?—Yes.

668. How long have you known this district?—I have lived here during 27 years.

669. At that particular place?—Yes.

670. Are you a native of this place?—No, but I had worked for the company before then; I have been with them turned 30 years.

671. Engaged on the river?—Yes, I was engaged on the river Aire before I came to Stanley Ferry; I came to Stanley Ferry in 1839.

672. Who constructed that aqueduct?—Mr. Graham was the contractor; Mr. Leather was the civil engineer for it.

673. What condition was the water of the Calder in at that time?—It was very good at that time, and there were plenty of fish in it. I have fished in it and got several sorts of fish. I have caught chub, dace, bream, and pike, and sometimes I have caught some salmon-trout.

674. At about what date, as far as you can recollect, did the fish begin to diminish in number?—About 12 years back.

675. Not more?—No, we have scarce seen any fish now for these several years; now I do not see any.

676. Do you think there is such a thing as fish in it?—It is possible, but I do not see any, they used to be playing about on the top, running by scores and hundreds.

677. What form does the pollution take, is it from sewage, or from manufactories?—All sorts of filth come—refuse from every place. I have seen more than 40 dead dogs pass in a day when the flood has been on; I do not say regularly, but in a case of flood, dead pigs in a putrid state, and dead calves in a putrid state.

678. (*Mr. Harrison.*) Those are dead dogs and calves which have been lying on the banks of the river decaying, and which the flood took from the bank and carried past you?—Yes.

679. (*Chairman.*) Is it the duty of any person to take those carcases out and bury them?—I am not aware of that.

680. It is not your duty?—I have taken some of them and buried them when they have been very bad indeed, when I could not bear the smell of them.

681. It was no part of your duty, and you would not have been complained of if you had not done it?—No.

682. You were not paid for doing it?—No, I did it without being paid.

683. Do you know what height the floods rise in your river opposite your ferry, vertically, from extreme low water to extreme high water?—Yes, about 16 feet, sometimes the flood will flow right over the top; I have walked across the aqueduct when the water has been flowing over the top of it, that was in 1840, January 24th, at half-past 3 in the morning.

684. Was the waterway beneath the duct impeded by the wreck of trees and timber and things floating down the river?—Yes, at times we had an accumulation against the breakwater.

685. A blocking of the stream?—Yes, the stream was nearly as high at the low side as the top side.

686. Were you not afraid that the aqueduct would be carried away?—I hardly knew then what it would bide. I was never afraid of its going away after that I saw what it would stand, and something else, I saw it counterbalanced. I mean by counterbalanced, that the water at the low side flowed back against the aqueduct and counterbalanced the water at the top side.

687. Do your banks wash away very much during

those floods?—In some places a little, not a very great deal.

688. Has the river altered its course in any part; is it dug out on one side, and is land formed on the other?—In some places willows have been planted, and forced the water to the other side, and then it will dig under the bank.

689. Who plants the willows?—The landowners and land occupiers, I believe.

690. And they have the advantage of cutting the willows when they are grown?—Yes, and they do so.

691. The persons who employ you do not control that kind of thing?—No.

692. You have no power over it?—No.

693. Do you think that the bed of the river is any higher now than when you first knew it; has it been filled in by solid refuse thrown in above in any place?—In several places it has.

694. Does the river flood the adjoining land anywhere near this ferry of yours?—Sometimes, but very seldom.

695. I believe the banks are very steep there?—Yes, they are, the water has to rise about 16 or 17 feet before it can come over the duct.

696. Do you know the river above and below you?—Yes,

697. Are there any areas below or above that are covered with water during floods?—At times the water is backed up; there are drains, outlets into the river, and if the door is not shut in a case of flood, the water runs up them and gets over the land.

698. Outlet drains from the land with self-acting flaps to keep the flood water going back?—Yes, if anything gets in and keeps the door open the water goes up.

699. Have you the charge of any of those flood-water outlets?—No.

700. Has any one charge of them?—I am not aware that there is anyone; the landowners themselves attend to them, I believe.

701. Do you think as much water comes down the river now in a flood, as came down when you first knew it?—Yes, I think so; it was in 1840 when that large flood was; we have not had one to equal it since.

702. Did the Holm Firth flood come down the Calder?—Yes.

703. Did that flood bring any bodies down as low as this?—Yes, I picked up one myself that came to my place in 1852.

704. So far as you can judge, the floods are now as heavy as when you first knew the district?—Pretty near the same.

705. You do not think that the water has fallen off from any cause?—No.

706. You are below the waterworks, are you not?—No, I am above them.

707. Would those carcases of dogs be floated down past the waterworks?—Yes, they would.

708. Do you think, according to your experience, that measures could be taken to prevent this pollution of the river?—It is quite possible that all the dogs might be got out before they came to the waterworks.

709. You could prevent that much?—Yes, that is one thing; then there are dead pigs which come down very much putrified.

710. How have those carcases got there?—I think they have been put in; some of them have weights of stones tied to their necks.

711. That is in the case of dogs?—Yes, and pigs and calves I believe have been thrown in.

712. Do cows and horses come down?—I cannot say that we have any.

713. To whom do the tolls of the ferry go?—I pay them over to the company; the Aire and Calder Navigation Company.

714. Are they as much now as they were when you first went there?—About the same.

715. How much do they amount to in a year or a quarter?—I am sure I do not know exactly, the average will perhaps be 100*l.* a year.

716. At what time of the year, as far as your experience has gone, have you the heaviest floods?—Generally winter time.

717. After the melting of the snow?—Yes, after a long succession of rains.

718. Do you know whether there are fish in the river above you for any distance?—Sometimes I take an occasional walk that way, but I never see any fish now; I used to do.

719. How many miles above do you go?—I go from the ferry to Kirkthorpe dam, about two miles.

720. (*Mr. Harrison.*) Is the river embanked near where you live, on each side?—Yes, it is, there is an embankment on either side, of something like about two feet in places.

721. Do the Aire and Calder Company dredge the river at any time?—They do. We have the dredger here. He is now present, and he has been a dredger for these 39 years.

722. Do you know what the fall at the several locks in the river is, above and below you?—The fall is from 5 feet to 7 feet, or 7 feet 10 inches.

723. What is the fall at the lock above you?—It is level at times when there is a flood, that is, Broad-reach Lock: it has floodgates. It is the feeder of the canal.

724. (*Professor Way.*) Does the river smell at your place?—In hot weather it does very badly.

725. Does the river itself smell, or the banks, when the water is low?—Yes, at times they do, the mud and thick matter.

726. That smells badly?—Yes; we have openings in the banks and settlings, and there will be sometimes from 2 feet to 2 feet 6 inches of all kinds of thick matter, and if you stir that it smells badly.

727. Then a quantity of air escapes and a bad smell?—Yes; in hot weather there rise up to the top of the stream great thick pieces of various colours.

728. And then break and fall down again?—Yes.

729. Is there much sickness about where you are?—No; I have been there 27 years, and I believe I am now the only one about there, all my neighbours have gone off, there is hardly one left there but myself.

730. Did they live to a good age?—Not very, some of them were very little more than half the age of me.

731. There is a little public-house close to the ferry, and there is a well there of peculiarly good water, is there not?—Yes; I am very fond of that water, I like it very well.

732. Do they use it for brewing at the public-house?—Yes.

733. Do they ever brew from the river water?—They used to do, at least they did at the other public-house, but they do not now, they have got a pump in as well.

734. They do not brew with the river water because the water is not good enough?—I do not know, most likely that is the reason.

The witness withdrew.

The witness subsequently informed the Commission that there had been a great flood on the 17th November; the water ran 2 feet 6 inches above the viaduct at half-past 5 A.M.

Mr. William Holmes (of Wakefield) examined.

Mr. W. Holmes.

735. (*Chairman.*) Have you charge of a dredger employed in cleansing the Calder?—Yes.

736. How long have you been employed on the Calder?—40 years come next April.

737. How long have you had charge of a dredger-boat?—About 17 years.

738. When did the Company first commence to use a dredger?—Before I came to the navigation.

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739. They have had a dredger-boat more or less since the navigation was established?—Yes.

740. Is yours a steam dredger?—Yes.

741. Of what power?—About 17-horse.

742. How many tons can you dredge in an hour with it when you are working full work?—If we had gravel, or anything like that, we could get out 60 tons in 20 minutes.

743. How many tons do you get out usually?—We are in general half an hour in loading a boat, and she will hold 50 tons.

744. What does it cost you a week to work your dredger?—The men that work these boats will take 36 yards, and they have 4½*d.* a yard for taking it and delivering it; we are constantly kept a-gait all the year round, there are 21 men continually employed with that dredger, that I have to deal with; I am the head of them.

745. What wages do they receive?—Sometimes they will earn 24*s.* a man per week.

746. Is the water and mud of the Calder any better now than it was formerly or worse?—It is a great deal worse.

747. Do you find that you have to take more sludge out than you did formerly?—Yes; we used to be three months together laid on one side in a year with the dredger, and during that time we used to go to work at something else. Now we have two dredgers, there is one at work at Ferry Bridge at present, and one at work at Castleford, beyond the junction with the Aire. I go between Wakefield and Goole, and Leeds and Selby, and that is as far as the Aire and Calder goes.

748. How many miles is that in a right line?—It is 31 miles from Wakefield to Goole; I think that that is far as we go.

749. (*Mr. Harrison.*) What is the distance from Castleford to Leeds?—Somewhere about 11 miles.

750. Is there any other district which you dredge besides those two?—No, that is as far as the Aire and Calder goes. My dredger is so big we cannot get through Wakefield Locks, she has more power than the new one.

751. (*Chairman.*) Do you dredge the Calder above the waterworks?—No, I cannot get there; where the waterworks are it is not now navigable.

752. You do not dredge up to the aqueduct?—No, but in the cut.

753. Not in the river?—No, we cannot get there.

754. As to the condition of the river, did you hear what Mr. Woolass said about dead dogs and carcases of pigs?—We have a deal to do with them, we have been surfeited, many of them have stones round their necks when they are thrown in, and when we light upon these we cut them in pieces with the pans, and they very near surfeit us.

755. Are there more dogs than there used to be formerly?—We have a deal more dogs and a deal more work. I can tell you one thing, I was dredging the Fall Ing lock half a mile below this dam. I saw three or four cargoes brought out together, consisting solely of ashes that came from the engines, they had been shot in by carts at night to get quit of them—ours is rather a hard service.

756. If you did not dredge those ashes out, what would happen?—They would make a shoal where boats could not go; if it was not for us there would not be a passage in the navigation at all.

757. Do you find more cinders in the river now than you did when you first began dredging?—Yes, a deal more, and of the stuff that comes through those mills and those manufactories, there is a deal of wool, nasty wool sunk in the river bottom by tons, short wool among the mud.

758. Is that difficult to dredge?—No, you can take it out all dry with your hands as if it had not been in the water.

759. You find much more of that than you did formerly?—Yes, a great deal more.

760. Have you any tan refuse to dredge out, spent bark?—No, I never see that.

761. Would that float away?—Yes.

762. Does the wool come most down the Calder or down the Aire?—I have had it down both. When I am dredging at Castleford I have to dredge in the Wakefield Dyke end as well as the Leeds Dyke end; when I dredge this Calder Dyke I can take that woolly stuff by handfuls out of the pans as they come up.

763. Do you ever attempt to do anything with it?—No, it goes into the boats, and we take it into the old river where we can get quit of it, in the old river that has been divided and is not used. It is very expensive work there, we are forced to have extra men when we are doing that, we have 25 men at present running that mud that we get out of the Leeds Dyke end, that is, out of the Aire.

764. What is the entire expense of your dredging boat?—It will be from 1*l.* to 30*s.* a cargo, and we are loading in sometimes five and sometimes six of the boats a day in that fashion there. Once they lent our dredger to the railway company, and charged them 5*l.* a day for it, the railway company finding all the men except the captain.

765. Did the railway company find the coals and the tallow and oil?—No, not the tallow nor the coals; the Aire and Calder company had to find them coals, but they found all the boats to take the stuff away. We employ six men on board of the dredger continually and we are never left idle on Sunday or work-day.

766. Where do you think most of the ashes come from?—A good deal comes from Wakefield, not far off from here either.

767. Where do they mostly come from?—I come and cleanse that shoal nearly every year, sometimes twice in the slack; there is one arch in the slack that has mud, and in some places there is a bed of sand, and coal slack, and all sorts of stuff.

768. I suppose the Aire and Calder company put the coal slack in?—I do not think they do.

769. Then the people who carry coals and use the river?—No, they do not, it is the coal masters; they have a screen on the nape of the stairs, and they neglect taking the fire-dust away; they have a place to catch it. I have seen tons run overboard into the river; but that is all neglect. I have seen that at Fox Holes, that is in Wakefield Dyke.

770. Do floods trouble you very much?—Not so much.

771. Do not they stop the dredging?—Very little, we can work with a four feet fresh.

772. What height does a fresh come occasionally, much above four feet?—At the topside of the dam it flows four feet, and if there are four above the dam, it will flow 8 feet below the dam, that is as much more.

773. Are four feet above as high as you ever have it over the dam?—No, we have had at the topside of the dam six feet.

774. Then will it be 12 feet below the dam?—Yes; where I live, at the dam at Pen Bank, as they call it—I have tried it.

775. Is the dam ever levelled fairly up, so that the boats could go right over?—Nearly so, when there is a heavy flood.

776. (*Mr. Harrison.*) What fall is there at the dam in dry weather?—About seven feet, in summer time, when it is low.

777. What is the length of the dam?—Forty yards, I daresay, I do not know exactly.

778. (*Professor Way.*) Do you know the well that has been referred to near to the public-house at the Ferry?—Yes, I have seen it many times at the pump.

779. Is it a deep well or a shallow well?—I do not think it is very deep, it will happen to be level with the surface of the river.

780. Does its height vary with the floods?—I do not know, but we have no right to use the well water down at any of those houses. I live under the Aire and Calder company, at one of the bridge houses, and we have no water to use but that which is in the canal and comes down from Wakefield.

781. Do you like it?—Sometimes we do not, it smells very bad in the day time.

782. Do you use it for cooking?—Yes, we have no wells, but at Pen Bank it is all hard water—cankery—and we do not like it.

783. (*Chairman.*) Does the smell ever make you or your men sick?—Yes, it nearly takes off our appetites sometimes, in the morning when we are cleansing sometimes, that is not here but at Leeds, we are forced to get a bit of bread to take the faintness off before we start, so nasty is the stuff that comes up.

784. Do you get any brandy?—Not much of it, we cannot afford it.

785. Have you known many of the men made seriously ill, or to have had fever after coming in contact with these bad smells?—I have been bad enough myself, and I have been laid up poorly 10 weeks together.

786. From what cause?—I cannot say, we have all sorts of weather to fight.

787. You do not know whether the bad smell has made any of the men seriously ill, but you have suffered from colds and occasional illnesses as other people do?—Yes, that is all, I do not know that it has made any difference to us.

788. You are no worse than other people that delve and ditch in clean places?—I think not, but the rivers are a deal worse than they used to be, they are shocking bad, and it is owing to the stuff that they are turning into the rivers continually, we can see on all sides of us the stuff coming in, when we are working at Leeds we see what is coming in, there are the chemical works there, those are bad. I loaded a boat at the side of one, and the men kept a cargo in the vessel all night, and when they got to bed they pulled their hatches on all snug, next morning one of them was almost dead, smothered with the smell of the cargo that they had in, it was that bad; he had work enough to recover, he was up in a different boat from me.

789. Do you remember whether he was able to work that day?—Yes; but very poorly he was all the day. It burns the shoes off their feet very near, does that stuff. Then we fetched the chemical works people up to the Aire and Calder Navigation Office about it.

790. Did you summon them?—No; we fetched them up without, and took a bucket of their nasty stuff that came up with the pans to the office, we fetched them up sharp, and they promised never to let it go in again, but they did.

791. Do the gas manufacturers let any of their foul refuse go into the river?—Not so much I think, very little, we sometimes smell a little, but very little.

792. It is the stuff from the chemical works that annoys you the most?—No; there are the dyeworks as well.

793. Does the refuse from them smell badly?—We dredge out all sorts of dirt below places where they make the cloth, those works are running in dirt constantly, running old rags and running the pouse in, and by that means they make a shoal in the river, and every vessel that is coming up is stopped on the top of it, while they are sending it in.

794. They are not very much afraid of you?—No, they are not. I told them I thought they would have to alter it, and it is time that they did.

795. Who are the gentlemen whom you consider your masters?—Mr. Bartholomew, the engineer, is our master altogether.

796. Does he look after those people when they are throwing this nasty pouse in?—No, he does not he does not meddle in that kind of thing, and that is what I am come here to tell.

797. (*Mr. Harrison.*) How far below Wakefield do your duties commence?—We go into the canals when we get to Broad-reach.

798. You dredge the river to within a mile of Wakefield?—Yes; we come in at the Fall Ing lock, about half a mile from the dam.

799. You do not dredge the river at Wakefield, or below it?—Yes, we dredge the river at Wakefield, at what we call Foundry Shoal, close to the Railway Bridge where the muck lies up and also up river to Fall Ing lock.

800. Do you dredge at all below the point where the Wakefield Sewer comes out into the river?—Yes, right away to the Cut-end, going into the canal, then we cannot get any further down towards the dam below.

801. Do you find any bank formed below the sewer that comes out of Wakefield?—No, it lies all the way down, and at the end of the canal as well; the canal is being raised all over with the filth that comes down the river, and the settlings of the water; we have to dredge in the canal above Stanley Ferry right away to the top of the Cut; I have dredged it all.

802. Where is the top of the Cut?—It is about a mile from Stanley Ferry to the top of the Cut.

803. Do the Aire and Calder Company dredge the river above where you go up towards Dewsbury?—Yes.

804. Is the person who looks after the dredger there here?—He is at Ferry Bridge now, dredging, he can get up above, he is dredging in the Goole Canal.

805. (*Chairman.*) Do you ever see any of the people about Leeds or any of those places bathing in the river?—Continually in that mucky water; here is the bridge, and that is the river (*describing*) just at the low side of Leeds, about half a mile off, they get on to that bridge and leap off; people tried to stop them, and some of the policemen watched them, to prevent them from stripping there right before folks, we have seen the boys constantly leap off that bridge into the river when we have been cleaning it out in 9 feet of water.

806. Do you know the point where the Leeds sewers go into the river?—Yes.

807. Is there a bank formed below the Leeds sewers?—Yes.

808. Is that formed by the filth that the Leeds sewers bring down?—Yes, the filth never gets out there, we have been working at the side of that sewer at the low side of Leeds. Sewage from that sewer comes in below Thwaite Dam, some distance from Leeds. There is a piece of the sewer which runs open may be nearly a quarter of a mile all open below Leeds.

809. With no top on it?—No, I went and looked that sewer over not long since, may be two months since I was there; I looked it over, the stuff was running down, but I could see no water, it was all over a froth and all sorts of nastiness were on the top, the top is continually covered with a scum, so that you cannot see the water, only where it delivers itself into the river; it falls into the river stiff with muck of all kinds.

810. Does that give you any trouble in the river below?—Yes; where I am working now at Castleford, on one side of the river it is very slack. I can find that stuff there, it comes up by panfulls, all sorts of nastiness, and it comes from that sewer, I am certain. I find that at Castleford, 10 or 11 miles off, it comes down the old river.

811. You think that it comes down from Leeds?—I am certain of it, sometimes when I have been forward on the dredger, a pan has come out with the muck, I have had to go right away aft nearly sick.

812. Do children bathe in the river below Leeds?—Yes, where there is a shallow place they will.

813. They go into the dirty water?—Yes; last summer I was cleansing at Leeds; I have been five months there now, cleansing below Leeds; you could see no water in that river for muck and nastiness.

814. On account of the scum?—Yes, at the top there was nothing but nastiness.

815. Did you ever see birds walking on that scum?—No, but I have noticed what takes place in the morning many times. When the beasts could get no water but this river water, in a field at Rothwell Haigh called the Waterloo Pasture, the beasts drank it, and began to die; they had none else, and they were forced to go to it, and they began to die in that

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pasture; several have died there; that was last summer, which was a bad summer; there were no freshets to take the dirt away.

816. (*Mr. Harrison.*) You did not take it away fast enough?—No, I was not able in one sense, as soon as the water became level with the dam, all that stuff used to run down, but then the paper-mills at Woodlesford below took all the spare water that they could get, so that the water did not run over the dam and there was nothing to take the dirt away.

817. In dry weather which takes most water down, the Aire or the Calder?—I should say the Calder by a good deal. We have a deal more water in Wakefield Dyke than we have in Leeds Dyke. This summer we have had a four-feet fresh, while we have had none in Leeds Dyke; it has run up Leeds Dyke, and when it has come down Wakefield Dyke as far as the dams it has backed up.

818. In a dry summer which has brought the largest quantity of water down?—We have a better supply down Wakefield Dyke than down Leeds Dyke.

819. Which is the most polluted?—Leeds, in the upper part, that is 10 times worse than this. When we are dredging in Leeds Dyke, we go anywhere for a sup of water; but in this dyke we can use the water; we have to use this water; but Leeds Dyke water when we are below Leeds, we cannot use, it is that bad, it would give us cholera directly, or anything else.

820. Are your men pretty healthy?—Yes, they are.

821. With regard to the shoals, are they formed chiefly after severe floods?—Yes, always; they always come down in the freshes, the freshes leave all the stuff behind them. Foundry Shoal is a constant thing for us, for the piers at the railway bridge are not put in strait to the water, and this causes a slack.

822. During the summer time when there is not much fresh in the river, are shoals formed at different points near manufactories, and so forth?—Then we are not in the river, we are in the canals then, where they are mudded up with settlings. In summer time when it is dry, we are not wanted so much in the river; if there is a shoal we remove it, we have come to one at present at Castleford, and we are taking it out. When we have done that, we shall be wanted at Foundry Shoal; it is bad.

823. During the summer time when the water is low, you are chiefly employed in the canals and cuts?—Yes.

824. Dredging away sediment which tends to fill up the canal?—Yes.

825. After floods in the winter time you are engaged in the river proper, dredging away shoals formed by floods?—Yes.

826. You cannot attribute shoal to any manufactories close by the shoal, as the materials might be carried down the river for 20 or 30 miles?—Yes, but where there is a slack after a fresh, the mud settles.

827. (*Chairman.*) Do you ever find any dead fish coming down the river now?—Not now, there are none.

828. You see no fish living in the water?—No, there are a few gudgeons I believe at the Frost Dam, or Pen Bank Dam, as we call it.

829. Are there fish in the river?—No; none to be seen.

830. There are fish in the river up in the mountains away from the manufactories?—Yes. I think there is nothing of the sort in this dyke. I have seen odd ones coming down above the manufactories at Leeds, but they have been weak when they have got down. I have seen them floating about at the top to escape from the nasty water, they have come down from above out of their latitude, and they cannot get back again over the dams. There is death for them if they get below Leeds.

The witness withdrew.

Mr. J. Sykes.

Mr. Joseph Sykes (of Wakefield) examined.

831. (*Chairman.*) Are you secretary to the Waterworks Company?—Yes, and manager.

832. I believe you have copies of the Acts of Parliament under which your company has been established?—Yes, and I have great pleasure in handing them in.

833. How long have you acted as secretary and manager?—I have acted as secretary since 1862. when we were re-incorporated under our last Act of Parliament, we were obliged to have an official manager, and I have combined both capacities.

834. The sources of your water supply consist of spring water and river water?—Yes.

835. About what proportion does one bear to the other?—There is about one-fourth of spring to three-fourths of river water.

836. About what daily volume do you supply now?—About 700,000 gallons per day.

837. Do you find that sufficient for your present requirements?—Our water is on during the whole 24 hours. The town takes just as much as it requires.

838. Do you know whether the whole town is supplied, or only part of it?—Almost the whole town, now.

839. Have there been any complaints of scarcity of supply at any time within the last 12 months?—I think not within the last 12 months.

840. How much do you supply for manufacturing purposes?—As nearly as I can calculate we supply 200,000 gallons a day for manufacturing purposes, and 500,000 gallons for domestic supply.

841. Do you supply the three great establishments, the gaol, the workhouse, and the county lunatic asylum?—We do.

842. Upon what terms do you supply the gaol?—At 300*l.* per annum.

843. And the asylum?—We supply the asylum by meter, at 6*d.* per 1,000 gallons.

844. And the workhouse?—On the same terms, but subject to a scale which we have by meter, ranging from 1*s.* to 6*d.*

845. How long have those three establishments been supplied with your water?—I can scarcely say; I think ever since I have had to do with them.

846. Before the company supplied them, do you know how they obtained water?—The prison was chiefly supplied with gathered water from the roofs and springs in the neighbourhood.

847. And the asylum?—I believe in the same way.

848. And the workhouse?—That has not been established so long. They do procure water for themselves partially now. They do not take much water from us.

849. Have there been at any time within the last 10 years epidemics or outbreaks of disease in this district, which have effected the inhabitants of the towns and inmates of those establishments?—Yes.

850. At what periods within the last 10 years?—Both establishments were effected by the last visitation of cholera to a serious amount.

851. Did you always filter the water?—Not always; the water was supplied for many years without any filtration whatever.

852. From the river?—Yes, except a mere straining through cocoa-nut fibre.

853. When did you find it necessary to begin sand filtering?—About five years ago.

854. You have recently, I understand, adopted Mr. Spencer's mode of filtering water by carbide of iron?—Yes.

855. How long has that been established?—Since August 1864.

856. I understand you are extending that principle now?—We are.

857. Do you find that a satisfactory mode of treating the water?—Yes, very satisfactory.

858. Have you any idea what it costs you per gallon, or per 1,000 gallons, to filter by Mr. Spencer's

process?—I have not gone into that calculation, but I can furnish you with that information if desirable.

859. Do you pump all the water into a high service reservoir, both from springs and from the river?—We pump it first into our store reservoir, at Stanley Ferry.

860. What is the lift there?—About 30 feet. Then we pump it to the upper reservoirs with a lift of about 200 feet.

861. What is your total horse-power?—Only one engine is used for both purposes. We have two engines, and we use about 25 horse power nominally.

862. Have you at any time suffered inconvenience from a scarcity of water owing to the dryness of the seasons?—Never.

863. Do you always find sufficient water in the river?—Yes.

864. Is the spring supply at all affected by the dryness of the season?—Yes.

865. Did it fall off at the beginning of this year?—We have not any good method of observing what the springs really make.

866. Which do you consider the softest quality of water, the spring or the river water?—The river water is much the softer.

867. Has there been any association with the Local Board for the purchase of your works?—Yes.

868. About how long since?—As far back, I think, as I can almost remember.

869. When was the most recent attempt made?—In the latter end of 1862.

870. That came to nothing, I understand?—Yes.

871. Do you publish annual accounts for your shareholders?—Yes.

872. Do they contain the capital account of the company?—Yes.

873. What is your capital account as it stands now?—Up to last June it was 60,000*l.* in round numbers.

874. That is a little more than 2*l.* per head upon the population?—Yes.

875. Your annual working expenses are how much?—For that year they would be about 2,500*l.*

876. And that capitalized would represent how much at 5*l.* per cent.?—Something like 50,000*l.*

877. That, added to the 60,000*l.*, would give you a capital of 110,000*l.*?—Yes.

878. If the Corporation contemplated purchasing your works, they would have to contemplate an outlay equal to the capital, the interest on which would represent your working cost and your nominal capital?—Yes, and something else besides.

879. What dividend do you pay?—Six per cent at present.

880. If your works were purchased you would expect them to be purchased on a 6 per cent. basis, at least, with a prospective increase of value?—Just so.

881. Is there any likelihood of the Corporation doing that?—Not if we are to judge of the future from the past.

882. Are your company quite content to be left alone?—Perfectly so; they have no desire to sell, we wish to remain as we are.

883. If any rival scheme were to be set afloat, promoted by the corporation, or by any persons in opposition to you, would you resist it?—Certainly.

884. Have you heard of any such rival scheme being proposed?—Not lately.

885. Have you heard of Mr. Dale's scheme to bring in water from Cumberland Lake?—Yes.

886. Does that alarm your company?—Not a whit.

887. Was not a scheme proposed by Mr. Ranger?—There was one propounded by Mr. Ranger some time ago.

888. Where did he propose to take the water from?—From the neighbourhood of Dakin Brook.

889. What was his estimate?—I do not know what his estimate was.

890. Did the proposal come to anything?—No.

891. Will the works intended for the supply of Leeds come anywhere near Wakefield?—No, they are quite in another direction, they will not affect us.

892. There are waterworks for Dewsbury, Batley, and Heckmondwicke, are there not?—Yes.

893. Will they affect you?—No.

894. How far is Dewsbury from here?—About six miles.

895. Is Wakefield lower or higher than Dewsbury?—Lower.

896. Mains continued from Dewsbury might supply Wakefield?—Yes, if there was water to supply us.

897. Will you describe to us as briefly as you can the process of filtering by the carbide?—Do you mean the chemical process, or the mechanical process?

898. Both, first of all what is the surface area of your filter?—At present it is about 1,100 square yards.

899. What is the weight of carbide in your filter?—We have taken one ton of carbide to three square yards.

900. Then you calculate that each square yard will filter a certain number of gallons a day?—Yes. At present we are obliged to filter our water much more quickly than we should like to do.

901. Are you filtering it now more quickly than you intend to do?—Yes.

902. Are you constructing additional filters?—We are constructing about 1,400 square yards of additional filtering space.

903. Do you propose to use those 1,400 yards at the same time that you are using the other filter?—Not exactly.

904. Then you will use the 1,400 yards, and the 1,100 yards alternately?—The 1,100 yards are divided into two filter beds; we are also constructing the 1,400 yards in two beds, so that when finished we shall have four filter beds; we find it necessary occasionally to let the filtering medium have a quantity of air, therefore we propose to work two or three filter beds as the nature of the water requires, and to have one in fallow.

905. Then according to the condition of the water you will use one, two, or at the most three of the filtering beds?—Yes.

906. Always leaving one fallow to come in alternately as you throw the others off for cleansing purposes?—Yes.

907. Then your maximum power of filtering will be the area of three of those beds?—Or four, if we think proper to use four.

908. Then you cannot have a fallow one?—No; three beds will represent the area that we shall have in use ordinarily.

909. And the largest area which you could use would be that represented by the four filter beds?—Yes.

910. Have you any idea how long your carbide will continue to be effectual if you put it in in this manner?—If the media which we are now using in the filter beds last in the same way as some that we have been experimenting upon, I do not see that there is to be any end of it at all. I have now some material which I have used over seven years, and I believe that it is perhaps more effective to-day than it was on the first day that it was put in. I am speaking now of a mere portable filter, but what is true of one will be true of the other.

911. Then as far as your experience leads you to judge, if the material is properly applied, you may go on using it continuously?—Quite so.

912. Have you paid sufficient attention to the mode of action, to explain briefly how this carbide is supposed to act upon the water?—Yes, but I do not feel competent to give a description of the chemical process.

913. Can you give a description of the mechanical process, and state how these filters are constructed. Supposing that your pumps have to lift the water, you have screening chambers between the river and the inlet of the pumps?—We have no screen whatbetween the river and the pumps.

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914. Then your water is lifted into your store reservoir?—Yes, direct.

915. Does a deposition take place in that store reservoir?—Yes.

916. After that deposition has taken place, the water flows to the pumps to be lifted into the filter beds?—Yes.

917. Do you screen it by cocoa-nut fibre before it gets to the pumps?—Yes.

918. By one thickness of cocoa-nut fibre?—Yes.

919. How long will the screen work without cleansing?—Sometimes a fortnight and sometimes three weeks.

920. Is it foul when you take it out, or merely obstructive?—It is merely obstructive; it is not very foul.

921. And you wash it and put it in again?—Yes.

922. Have you cocoa-nut fibre strainers up at the filter beds?—Yes, previous to the water going on to the filter beds.

923–4. Have you then arranged perpendicularly and horizontally?—No, only horizontally.

925. Over an iron trough?—Yes.

926. Then the water passes on to the town, the sand forming the surface of your filter bed?—Yes.

927. What is the depth of that sand?—18 inches, but that is according to the nature of the cleansing, we do not put the sand on for filtering purposes, but to intercept.

928. What does the sand rest upon?—It rests upon the carbide.

929. The carbide is immediately under the sand?—Yes.

930. What carries the carbide?—The carbide is carried by a stratum of small gravel.

931. Of what thickness?—About three inches.

932. What carries the gravel?—The filtering drains.

933. How are these drains constructed?—They are square brick drains, and we suppose them to be tightly cemented. There are apertures at the top of those drains, and upon them we place a peculiar kind of delivering cup.

934. Those delivering cups are for the purpose of admitting the water and, I presume, admitting a certain amount of atmospheric air?—Yes, and checking the flow of water into the drains, our object being to keep the water in contact with the carbide as long as we possibly can.

935. Are those drains filled with the filtered water, or have you air space above the top of the water in the drains?—So far as I can see I do not think that the drains are at any time charged above one-fourth.

936. And necessarily nine inches out of twelve would be charged with air?—Yes.

937. And the air would be rising up into the filtering matter above?—We think so.

938. It comes up through the conduits which you have provided?—Yes.

939. Does it bubble through the sand?—Yes, but slightly—not to any great extent.

940. If you did not provide proper channels it would blow the sand up?—Yes.

941. And in fact would destroy your filter bed?—Yes.

942. How frequently do you scrape or cleanse your sand?—Sometimes after ten days, sometimes a fortnight; we have gone as long as three weeks without having to interfere with the top sand.

943. Then you wash that sand and use it again?—Yes.

944. Washing the mud away?—Yes.

945. Do you know any other place where carbide is used on so extensive a scale as yours?—I have not seen any other place.

946. Have you heard of any?—I have heard of some.

947. Where?—At Wisbeach, Southport, and several other places, which I cannot now call to mind.

948. Do you know whether it is used at the Liverpool Waterworks?—I do not.

949. Have you had occasion to try whether it would take out any vegetable taint, supposing that you had a moss water?—No.

950. Does it effectually take out any remnant of dye in your water?—Yes.

951. Is not your water stained occasionally with washings of dyeworks?—I have not seen it so stained materially.

952. Is the water of the river not blue above the works?—It may be blue above, but I ought to state that the time we choose for replenishing our store reservoirs is after we have had a fresh in the river, and not when the river is low.

953. What will your store reservoir hold?—I do not know, it is nearly five acres.

954. Of what depth is it?—About 15 feet.

955. Have you found it necessary to cleanse it?—We have only cleansed it once since the works began.

956. What did you get out of it?—We got mud from it.

957. Have you any fish in that store reservoir?—Plenty.

958. Of what sort?—I am no fisherman myself.

959. But fish do live in that stone reservoir?—Yes.

960. Although none live in the river?—Although none live in the rivers. We have had such numerous applications for fishing that we have been obliged to adopt this practice giving permission to fish (*producing a card*).

961. Are those cards for fishing issued now?—No, we have not issued any since we cleansed at the latter end of 1862.

962. Have you then in cleansing destroyed the fish by emptying the reservoir?—The reservoir was completely emptied and re-pitched, we did not put in any fish, but there are thousands in now.

963. (*Mr. Harrison.*) You have said that you supply about 200,000 gallons a day to the manufactories in the town?—Yes.

964. Can you give us the details of that supply to the different manufactories?—Not now. If you deem it desirable I can give you particulars as to every customer that we have.

965. The manufacturers themselves of course know the quantity which you supply to them?—We generally supply them by meter.

966. Do you find much difference in the level of the well from which you draw the water near the river at different seasons of the year?—Yes, the water in our well is always on a level with the river, of course as the river rises the water in the well will rise.

967. Do you never drain the water below the level of that in the river?—No.

968. Is the culvert between the river and your well perforated to a considerable extent so as to allow the spring water to pass in?—Yes.

969. That is the water from the gravel?—That is the water from the gravel strata along the culvert, it comes originally from the river.

970. During heavy rains where would the water come from which supplies the springs, perforating through the culvert?—I should think that a great portion of it would percolate through the soil; it is a gravelly stratum.

971. Is there a large area of that gravelly stratum?—Yes, a very large area.

972. Then in very wet seasons you might be drawing water entirely from that source, and none from the river?—In very dry seasons we might, but not in wet seasons because there would be so much water in the river that it would be almost impossible to get water from any other source than the river, the well being so thoroughly charged.

973. You mean that the level of the water in the river is higher than the level of the water in the land through which the culvert passes?—Yes.

974. So that the water in that case will be rather water going from the culvert into the adjoining land, than from the adjoining land into the culvert?—Yes, and I have no doubt that it does so to a great extent,

and then we get it back again, and filtered naturally to a certain extent.

975. Is the surface of the water in the river ever so low that it reaches the gauge over which it flows into your culvert?—It has been so, but very seldom.

976. At that time you would be drawing entirely from the leakage into the culvert?—Yes.

977. That would be in a very dry season?—It would.

978. What is the character of the water then?—It is very bright, clear water; it is rather hard and must contain a great portion of iron.

979. In very wet weather what is the character of the water as compared with that in the river?—It is very similar to that in the river; it is similar in character to the water which is obtained from the pump by Stanley Ferry.

980. (*Professor Way.*) I suppose that this water varies according to the season?—Very much.

981. Sometimes it is almost all what you call spring water, which is water that has percolated the surface, and sometimes it is almost all river water, and sometimes it is a mixture?—Yes.

982. You say that you take the water in the time of flood?—Just after the flood.

983. Therefore your storage reservoir must be full of river water, or surface water?—Yes.

984. And the river water is the softer of the two —It is.

985. What do you suppose is the general character, with regard to hardness, of the water which you now supply to the town?—The maximum may be about eight degrees of hardness.

986. And how low do you think it falls?—To five degrees.

987. Do you know what the river water is?—I do not know what it is now. I have a report published in 1852, which states the result of an analysis of a sample of the water made by Mr. West, of Leeds, and also by Dr. Lyon Playfair, but Dr. Lyon Playfair does not give the hardness; Mr. West does give the hardness, and he makes it to be $2\frac{1}{2}$ degrees.

988. (*Chairman.*) Who made that report?—This is a report published by the Town Council of Wakefield; a report upon a preliminary inquiry; it is Mr. Ranger's report.

989. (*Professor Way.*) That was before you began the system of filtration?—Yes, long before.

990. Were not you at that time filtering through sand filters?—Yes, but not very extensively.

991. Have you an analysis of the water since then?—Yes, we have had several. I have an analysis which was made by Mr. Dugald Campbell, of Chancery Lane, in February 1862. It was made previously to our laying down the present filters.

992. You laid down the filters in August last?—Yes. The reason why this analysis was got was that the system of filtration had been under experiment, and of course we had only been advised by Mr. Spencer, and I thought it necessary before we really went to the expense of laying down these filters that we should have an independent opinion from some other analytical chemist. I therefore selected Mr. Dugald Campbell, because he was employed by the Local Board of Health at that time, and I thought that if they had confidence in Mr. Dugald Campbell, I might have confidence in him. The consequence was that I filtered a sample of water through a portable filter made upon the same principle as we have now adopted, and I submitted the water to Mr. Campbell, and this is his report and analysis, and that report and analysis determined us to lay down the present filters.

993. This analysis shows half a grain of organic matter in a gallon, nearly 15 grains of total solid residue, and nearly 8 degrees of hardness?—Yes.

994. There was no analysis made at the time of the water without filtration, so as to compare the two?—No, not at that time.

995. Have you at any time had such an analysis made in order to ascertain by direct experiment the effect of Mr. Spencer's carbide; that is to say, have you had the water analysed before filtration and after filtration?—No. After these filters had been laid down and had been in operation for three months our directors felt it desirable to have the water analysed, and not only by one individual, but by three or four; and three or four of the most eminent chemists in London were selected for that purpose. Samples of water were delivered personally by myself, and each gentleman sent down his report, which report was published in the newspapers, copies of which I shall be very glad to hand to the Commissioners and they will see by the papers who the gentlemen were.

996. Do you know whether Mr. Spencer has in any case obtained a report on this process of his from any chemist of eminence, independent of himself?—I do not know that he has. We have not relied upon Mr Spencer at all in this matter, but we have rather put ourselves in the hands of eminent men, in whom we could have confidence.

997. Is it Mr. Spencer's view that the action of carbide is to oxydate the organic matter principally?—Yes, and to destroy it.

998. And that in so oxydating it the carbide itself undergoes a change, and recovers its capacity for this oxydation by mere exposure to the air?—Yes.

999. It is renovated by exposure to the air?—Yes.

1000. Then your object in having more than one filter-bed is to expose the carbide to the air after its action has begun to cease, in order to renovate it?—Yes, after it has become sick, so to speak.

1001. That is Mr. Spencer's view?—Yes.

1002. And you think that that is practically the case?—Yes.

1003. Have you run your filters for any length of time without exposure to the air?—Yes.

1004. Have you found that they are improved by that exposure?—An hour's exposure is quite sufficient.

1005. The water was getting less and less purified towards the end of the course of the use of the filter, and when you began again you have found that the water was improved?—Very much improved.

1006. So that you think that your practice confirms the theoretical view of Mr. Spencer?—I am almost assured of it.

1007. You had not attempted to ascertain the difference produced by the action of this filter, but you seem to have been content to find that the water which is passed through it is a pure water?—Yes.

1008. Is the water softer or harder after being passed through the filter?—The water in the Calder has been gradually getting harder for the last eight or nine years.

1009. Supposing water of a certain hardness to be passed through these beds of Mr. Spencer's, is the hardness increased or diminished by the filtration?—I believe that it is increased, but not more than one degree, if so much.

1010. I fancy that Mr. Spencer claims as one of the advantages of his process that the hardness is diminished?—I do not know, we have never experienced much more hardness in the water after, than before filtration.

1011. You believe that if the water as now supplied to the town is harder than it used to be, that is in no way connected with your filtration?—Just so.

1012. But that it is due to other causes over which you have no sort of control?—That is my opinion.

1013. That is to say that you are not hardening the water?—I do not believe that we are hardening the water at all.

1014. To what cause would you attribute what you conceive to be the additional hardness in the Calder of late years?—I believe to the amount of chemicals used in manufactories, which are now turned into the river.

1015. The river is getting more impure in salts, which produce hardness, as well as more impure in other things?—Yes.

1016. You will remember that when we were here two or three months ago we collected some samples of water from your reservoir?—Yes.

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1017. From the water which was running into the filtering beds, and the water which was leaving the filtering-beds?—Yes.

1018. I suppose that the water which was running into the filtering-beds would be a mixture of the spring and the river water?—Yes.

1019. From the store reservoir?—Yes.

1020. Would that be an average of the water which you are supplying?—No, because then there had been a long drought, and the water always becomes harder in the Calder after a drought.

1021. Had you been pumping water from the Calder?—Yes, previously to that, but we were then pumping from springs.

1022. You think that it was harder than the average?—A little, but you may take that as about a fair average.

1023. Would the water which we collected on that occasion, represent water before it gets into Mr. Spencer's filters, and water after getting into his filters?—Yes.

1024. So that the amount of influence exerted by those filters might be taken as represented by the difference between those samples?—Yes.

1025. Cannot you tell us the price paid for the filtering material?—I do not think that I am in a position to do so.

1026. I see that there is the sum of 37*l.* put down for filtering material?—That will be sand.

1027. In your opinion it is not such an expense as would prevent the process being applied to river waters generally?—By no means.

1028. Would there be any difficulty in getting any quantity of the material for other towns?—I believe not.

1029. (*Chairman.*) Is there anything which you wish to add to your evidence?—I have another analysis which was made by Mr. Spencer in September, 1865, of four samples of water.

Mr. F. Lumb.

Mr. Frederick Lumb (Wakefield) examined.

1030. (*Chairman.*) Are you solicitor to the Waterworks Company?—Yes.

1031. How long have you known the district of the Aire and Calder or Wakefield?—I was born in Wakefield and I am now 60 years old. I obtained the first waterworks Act of Parliament. The prospectus was published in 1836, and the Act passed in 1837.

1032. You have known the river for a term of 50 years, so as to remember its condition?—You may say so certainly, but I would rather say 40 years.

1033. Do you find the quality of the water different now from what it was in your boyhood?—Very different indeed.

1034. It is fouler?—Very much fouler. I remember staking the river with pegs just below the Wakefield Mill Dam to prevent the people fishing with nets, that was since I was 25 years old.

1035. What does the pollution consist of, so far as your knowledge goes?—It comes from a great distance along the whole valley of the Calder. There is a quantity of filth poured in from Hebden Bridge, and from the Hebble which runs in at Halifax, and the Holmfirth drainage comes into our river.

1036. Do you know what the common law of England is with regard to pollution?—The common law so far as I understand, is that you have no right to pollute a river at all.

1037. Supposing that there are dye works, and we will say that your house is situated on the bank of the river, could you as an individual bring an action against the manufacturer for polluting the river?—I have a right to do so, but the chances of recovery are not quite so certain. You know the case of the Birmingham Corporation, they were attempting to put their sewage through some water which ran into a gentleman's park; he tried the case with them, and he obtained a perpetual injunction against them.

1038. That was Mr. Adderley?—Yes.

1039. They had been polluting that water ever since Birmingham was there?—Quite so.

1040. The pollution had grown up with the growth of the place?—No length of time will sanction a pollution. I think that the law is so laid down.

1041. Then Parliament, if it chooses to legislate for the future of this river, will have a very good precedent to go by?—I think so.

1042. And there need not be any very great difficulty in so framing the law, that it shall be put in force against persons who pollute a river or pollute streams?—Parliament of course could enact a severe law, but the question is, the mechanical difficulty of how towns are to dispose of their sewage, and how people shall still continue their manufactories.

1043. But if you say that they shall not do it, or shall be fined to a certain extent if they do, you leave the remedy to them?—Certainly.

1044. Is not such a thing known to the law as a constantly recurring fine as often as the nuisance is repeated?—Yes, so far as the law is concerned, I should say that no length of time will sanction such a nuisance.

1045. And the law has not been recently made, but it is the old standard law of England?—Yes.

1046. Therefore the pollution of rivers has come into existence because there has been no person to put the common law in force?—Certainly, people would not undertake the difficulty and expense of an action because manufacturers would combine, and they would form a body in contending with whom you would find a great deal of difficulty.

1047. Although the common law of England is in favour of preventing pollution, the machinery of the law enables wealthy people to carry a case from court to court, and from assizes to assizes?—I suppose that that is so.

1048. With regard to the waterworks, have you paid attention to the condition of the water which is taken from the river?—Yes, I was a director for some short time, and Mr. Sykes and myself were continually there, and we saw that the impurity was increasing and often thought what was to be done. We tried once a common sand filter without this carbide. We found that it had no effect, except perhaps in straining out the fine mud, that no doubt made the water better and more pleasant to the sight, but did not get the organic matter out.

1049. Do you now get the organic matter out?—We are told so.

1050. I suppose that the growing pollution of the river, and the deterioration of your water, would give you and the other directors serious anxieties?—Yes, Mr. Sykes was the first person who hit upon this plan. Mr. Spencer delivered a lecture many years ago at Aberdeen, and Mr. Sykes having seen this plan in operation asked Mr. Spencer to communicate with him upon the subject, thinking that it would do good, and I believe that it has done good.

1051. Are you aware of the extent to which the treaty made many years ago, for the sale or proposed sale of your works, went?—Yes, there was once a treaty many years ago in writing, it was delivered to the corporation, but it went no further. I think that then they were not a local board, but I am not quite certain.

1052. Do you see any prospect at the present time of a transfer of the works to the corporation?—If any proper terms could be hit upon it might be so, but I believe that the view which the corporation took was, that the works were not worth anything, but as old iron, and that it would be necessary to go somewhere else for a better supply, of course the company could not take that view.

1053. The corporation considered that if they bought the works, they must abandon the present source and go to another source?—Yes, and therefore the terms fell through. The company were then

advised by Mr. Hawksley and Mr. James Simpson, Mr. Hawksley said, "You have a revenue, and if you like to stick to it, you can make it better."

1054. Who laid the works out in the first instance?—Mr. James Simpson was the consulting engineer, but Mr. Billinton, a local engineer here, I believe really laid them out.

1055. And then Mr. Hawksley was your engineer?—Yes, he was consulted for two years. Previously to these waterworks being established, there was an application to Parliament which failed, to take the water from West Ardsley. It is very hard water and the scheme fell through. Mr. Simpson, I believe, was employed against the promoters of the bill, and that brought him into contact with this neighbourhood, and Mr. Billinton and Mr. Simpson between them devised the present waterworks, for which an Act was obtained in 1837.

1056. Do you drink this water yourself?—I do, as it comes to me by the pipes of the town.

1057. Have you ever heard any accusation against it of its producing disease?—I never have. I believe that the cholera was more prevalent in the asylum than it was in the prison, and the prison at that time was supplied by the company, and the asylum was not.

1058. (*Mr. Harrison.*) In what year was that?—In the year of the tremendous outburst of cholera here, which drove the medical officer from his post of duty.

1059. (*Chairman.*) That was in 1848 was it not? Yes, I believe you will find it all detailed in a book upon the cholera by Dr. Wright who is now in practice here. I always understood that the cholera could not be clearly traceable to the water.

1060. (*Mr. Harrison.*) Can you tell us how it was that the supply was taken from below Wakefield instead of from above the town?—I cannot very well. I think that above the town objections were made by some landed proprietors, and then, again, I think that the water below the town is much better. The Calder and Hebble Company would have objected in those days, and at that time, 30 years ago, it was exceedingly difficult to get ever so good an Act through Parliament. At that time you had not a select committee, you could get a committee together any way which you liked.

1061. And whatever may be thought of the river as a source of supply now, it was then, in your opinion, unexceptionable?—We thought so from the opinion of Mr. West, and all those who analysed it.

1062. (*Chairman.*) I suppose that Wakefield at that time had no sewers at all, or mere surface drains?—Yes, we had; but no person ever thought of such gigantic schemes as are now being propounded. Of course engineering has brought that forward. Bradford was in a deplorable plight, and so was Leeds. Bradford had Leather's scheme from Manywells and they then had to go elsewhere, it not being sufficient for them.

1063. (*Mr. Harrison.*) Since the formation of your works the river has been gradually more polluted of late years?—Very much so.

1064. Therefore if your works have become injured in value from the pollution of the river, you do not think that you ought to be sufferers from it?—We do not think that they have become injured, because we think that this filtration cures all.

1065. You have to go to the expense of that filtration?—Yes.

1066. And that is an increase of charge to your company, whoever may be the cause of it?—Yes. Again, we had Mr. Ranger's scheme to draw water from the Dakin Brook. We did not see that that scheme could be accomplished for less than 180,000*l.*; and the water was of the same degree of hardness. Whether Wakefield would like to spend that amount of money or not I cannot tell. I once fancied that we could have got water from Dewsbury, but they might have charged us 4*d.* a thousand gallons; and we could not then have sold water to the prison for 6*d.* a thousand gallons. Altogether the water supply is a difficult question economically, as well as from an engineering point of view. If the river could be freed from its pollution I do not think that we could have a better water.

The witness withdrew.

Mr. Stephen Roodhouse (Wakefield) examined.

Mr. S. Roodhouse.

1067. (*Chairman.*) What are you?—A shopkeeper.

1068. How long have you resided in Wakefield?—All my life.

1069. To what points do you wish to speak in this Inquiry?—It was suggested that I ought to come and speak before you on account of my having gradually watched the deterioration of the fish in the river.

1070. How long have you known the river?—I have been a fisherman more or less ever since I could carry a rod.

1071. How many years is that?—Perhaps 30. I used to keep a little diary for the purpose of telling me what sort of flies I had found efficacious in previous years; and of course that showed what the fish were fond of, and what quantity I caught.

1072. Where did the fishing take place?—From Horbury, which is about two miles above Wakefield to Stanley Ferry three miles below Wakefield.

1073. Will you give us the facts in any special year which you wish to take?—I find that in 1852, so far as my fishing was concerned, the river was about at its best that I remember. I used to go in the morning and get back to business, and in the evening after business, and these are the entries: I find that on July the 5th I was up at 3 o'clock in the morning, and was off to the river fishing; and I caught 24 fish, which weighed 14¼ lbs.

1074. What were they?—Principally chub and dace.

1075. Did you catch them with a fly?—Yes; there were plenty of dace there at that time. The dace being the more delicate fish of the two, vanished first. On July the 8th I see that I went again in the evening, and I got 24 fish again, which weighed 13 lbs.

1076. Take the next year?—In 1853, on June the 8th, I had only 4 lbs. On the 18th of June I see that I had 6¾ lbs.; on July the 9th I had 4 lbs.

1077. What is your next year?—On May the 22nd, 1854, I took 5 lbs. After that I never seem to have got above 2 lbs. or 1½ lb. all that year. I found that the stock of fish was going down, and that I could not catch them.

1078. Take the year following?—In 1855, on June the 29th, I seem to have caught only 1¼ lb.; and on June the 12th, 1½ lb. I can give the sum total of all the years. In 1852 I got 80¾ lbs. in about 12 times; in 1853 I got 48 lbs. in about a dozen times; in 1854 I got 38½ lbs. in 15 times. In the next year, namely, 1855, I went very often, and did not get beyond 13¼ lbs. In 1856 I never got a fish. I went two or three times, but it was of no use. Not wishing to give it up without another trial, I went again in 1857. I went several times, when I knew that if there were any fish they should be in the streams, and I only succeeded on July the 16th, when I caught three chub.

1079. Of what weight?—I do not seem to have put the weight. They must have been too small to weigh. A friend who was with me caught one, and I caught three. We went several times afterwards, and we never could find a fish in the streams.

1080. Have there never been any fish since then?—I never could get fish. There have been fish in since many times, because there are outlets into the river; for instance, there is the Barnesley Canal with plenty of fish in it; there is a beck running through Mr. Charles W. Worth's property with plenty of fish in it.

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1081. (*Mr. Harrison.*) Are those becks beyond any point of pollution?—They both come enter the river near Wakefield; one just below the town, and the other just above the town.

1082. But there is no pollution above those becks themselves?—No, they come into the river, and the fish with them; the fish are in the river a day or two and die away.

1083. If they get down to polluted water they soon die?—Yes.

1084. Your observations give us a sort of scale or the gradual pollution of the river?—Yes; I caught more fish before I kept this diary than I did afterwards. I kept it when I became a flydresser for my own guidance.

1085. Have you been accustomed to fish in the Company's reservoir?—Yes; the directors were kind enough to give us tickets. We used to fish in the reservoir for small fish as bait for pike, and we then had plenty of fish. I know that the men were careful when they pumped; they did not pump if they could help it when the water was the thickest, and they only took the water; they did not take the mud, and the bottom of the reservoir of course would not be so foul as the river. I have once seen water pumped in when it was so foul that I had to run. I used to fish in the stream from the pump. I have fished in that stream many a time, and never noticed foul water come into the reservoir but once. I remember fishing in it that day, I tried twice, and I could not bear it; and I know that I had to stop a good many times to cleanse my flies—they were full of cotton or wool.

1086. Have salmon been caught in the river below?—I remember one being caught when I was a very little boy; it was caught below Kirkthorp Dam, above the Newland estate.

1087. (*Mr. Harrison.*) Can you give us any further information?—No; my experience led me to this,—that the fish disappeared from the upper part of the river the soonest; they disappeared from Wakefield first; there were a few left at Dirtcar, just above the town, but they disappeared from there, and the latest to remain were the fish below the source whence the water was taken for the waterworks.

1088. How many miles above Wakefield do you speak of?—I mean that the fish disappeared three miles above sooner than they did three miles below Wakefield.

1089. I presume that in very many of the tributaries to the Calder there are fish now?—Yes, in every one. I know that there are fish at Castleford.

1090. And that only receives water from the Aire and the Calder?—The Holmfirth flood poisoned almost all the fish in the river, but after a little time fish came back again.

1091. Do you mean that there are fish now below the point where the Aire and Calder unite?—Yes; there are a few yet even at Frost Dam, a little below Pen Bank. I do not know whether it is below the junction or not, but a few fish keep appearing there; they are very few, and when they come to the mouth of the tributaries they die away.

1092. (*Professor Way.*) Might not the water at Castleford be purer from the fact of its being at a distance from a town?—Yes.

1093. Below Leeds you never see any fish?—No.

1094. In your experience as a fisherman, what do you think is most injurious to fish, refuse of manufactories or the excrements of the inhabitants?—Our theory was that people began to use more chemicals in the manufactories and in the dyeworks, and so on, and that when they used merely the woods they did not kill the fish so much.

1095. If a town was not a manufacturing town but discharged its sewage into a river would the sewage be as injurious as a discharge from manufactories?—I decidedly do not think that it would be so injurious. It would be bad enough, but I think that the chemicals are worse.

The witness withdrew.

Mr. W. Crutchley.

Mr. William Crutchley (Wakefield) examined.

1096. (*Chairman.*) Were you formerly the borough surveyor to the Corporation of Wakefield?—Yes.

1097. How long is it since you held the appointment?—It is, I think, about a year and a half since I left the Corporation.

1098. Are you in business in Wakefield?—I am.

1099. How long did you hold the office of surveyor to the borough?—About four years.

1100. Did you devise any system of sewers or drains at the time when you were in office?—I did. I devised the present system under which they are working. The plans which were sent to the Home Secretary would make the system complete, that is to say, the drawings show where the intended sewage and filtration tanks might be made to enter the river, arrangements were left in such a state that at any time it would be possible to put in a well, and pump up the sewage upon land. There is land contiguous, as the Mayor has said, very well adapted for distribution of sewage.

1101. Then the system laid before the Local Board to which they granted sanction, provided for depositing tanks, and ultimately for distribution of the sewage upon land?—Yes, that was the intention, but it was not shown upon the present plans.

1102. Still the question was named as being one which the Corporation might entertain?—Nothing was mentioned about the disposal of the sewage, but the plans were designed with that view.

1103. The general Board no doubt had all those facts communicated to them when they granted their sanction?—Yes; I have no hesitation in saying that I think they would not have approved of the plans without something of that sort.

1104. Do you know who approved of the plans?—I forget; they had the seal on them when they came down.

1105. Had you any inquiry here upon the plans?—No; there was a system devised by Mr. Ranger or Mr. Morgan. The plans are very similar in some respects, but there is one material alteration, and that is, that one of my predecessors of the name of Tarbotton, who is now surveyor at Nottingham, in putting in the sewer placed the outfall at a considerably lower level than Mr. Ranger had put his in. Now the policy of that is questionable, for this reason, in filtration you always require a greater amount of head, if the river is below its ordinary flow there will not be that head. With the present outfall there will be only about a foot between it, and the ordinary summer flow of the river.

1106. How much would the floods of the river rise above?—In some cases 3 or 4 feet, or more occasionally.

1107. So that at that time the outfall would be choked by the rising of the flood?—Yes.

1108. And the works could not be used?—Yes; there would have to be back valves to prevent the river water coming in. Under the arrangement as it is carried out, there always will be a danger of that water from the flooded river. Had this outfall sewer been put in at the depth shown on Mr. Ranger's plan, there would at least have been 2 feet more difference between the outfall and the summer level of the river.

1109. Would it have been above or below?—It would have been above the river, but at the same time it led to other difficulties, for instance, the difficulty of getting through Ing's beck, it would have contracted there, and in addition to that it would somewhat have destroyed the fall of one of the main sewers which is now going up Ing's Road, and Thorne's Lane.

1110. Did you carry out much house drainage during the time that you were surveyor?—No, I did a little, but I impressed upon the Board the necessity

of carrying out private drainage at the same time as they were carrying out the mains. I thought it of the utmost importance that the private drainage should be carried on under the superintendence and management of the borough surveyor.

1111. And the Board did not take any steps?—They did not.

1112. Have they hitherto allowed private parties to make their own drains?—Yes, unfortunately, and thus the Board would have little control over the private drainage.

1113. When private parties open a communication from their drains with the sewer do they do so under the supervision of the surveyor, or independently?—It is expected that it shall be done under the supervision of the surveyor, but they cover it up so soon that the surveyor would not like to incur the odium of having it opened up again.

1114. What salary were you paid?—At first 150*l.*, and afterwards 200*l.*

1115. (*To Mr. Morgan.*) What does your present surveyor get?—200*l.*

1116. Is he allowed to do any other business?—He is not.

1117. Do you allow him an assistant of any sort in the office?—There is a clerk in the office.

1118. Do you pay the salary of that clerk?—Yes; and in addition there is a Clerk of the Works—a practical man.

1119. Do you pay his wages?—Yes.

1120. What do you give him?—120*l.* a year.

1121. And what do you give the office assistant?—1*l.* a week.

(*Mr. Crutchley.*) I had neither of those, I had to do both in and out-door work myself.

1122. What are you doing now?—I am practising as an architect and surveyor.

1123. Are you acquainted with the kind of manufactures carried on here?—Yes, in part, but I am not prepared to give evidence upon that subject. Before I was borough surveyor here I was five years on the Aire and Calder Navigation as principal assistant engineer.

1124. When you have been up and down the district, have you noticed that matters have been thrown into the river which had better be kept out?—Yes.

1125. Solid matters of every sort?—Yes, in fact every kind of material is thrown in.

1126. Have you ever seen foundation material thrown in?—No.

1127. Or ashes?—No.

1128. Or building material?—No, generally a good deal of ashes fall in.

1129. But you have not seen an actual tip thrown in?—No,

1130. Have you ever been upon the river above Huddersfield?—No, but I have known the present river 10 or twelve years, and I can speak to its being considerably worse now than it was 10 or twelve years ago. In fact the manufactures of Dewsbury are extending so rapidly that you can perceive the difference within the last few years.

1131. The river is getting more polluted?—Yes.

1132. Have you at all acquainted yourself with the principle of sewage irrigation?—Yes. I have studied it, but I have never seen it carried out upon any large scale.

1133. Have you seen it carried out on any scale at all?—Yes. I have carried out irrigation works.

1134. Where?—At Leek.

1135. What is the population there?—15,000 or 16,000.

1136. What is the land?—Principally low meadow land.

1137. How many acres are there under irrigation there?—About 60 or 70 acres.

1138. Do they get any benefit from the irrigation?—No, it is not well carried out.

1139. Has Leek been properly sewered?—Yes. I believe that it has been sewered very well.

1140. Have you seen any sediment works carried out for taking the deposit, or sediment out of sewage?—No.

1141. Did you make the plans upon which the sanction was given for the 12,000*l.*?—Yes.

1142. When you made those plans did you make provision for preventing the sediment getting into the river?—Yes. I designed them principally for upward filtration. I had a through channel for the sewage into which I could place sluices, so that I could turn the sewage into duplicate tanks. I took one part of the sewage and passed it over a cill and then through a rough clinker medium, and again over another cill and through a finer clinker medium to the overflow.

1143. Had you had any opportunity of seeing how that would work in practice?—No. Some persons have recommended the upward filtration, and the vertical filtration, but I have never seen the downward filtration recommended.

1144. Do you know that they spent 5,000*l.* for the upward system of filtration?—Yes.

1145. And that they have had to abandon it?—Yes.

1146. And that filtration in regard to sewage cannot be accomplished?—I am not aware of that; much will depend upon the subsiding tanks.

1147. Do you know anything of the land situated on either side of the river below Wakefield?—Yes.

1148. Do you think that there is any land to which sewage could be beneficially applied?—Yes, but the sewage would have to be raised by steam power. There is a large area of land, and it lies very nicely for irrigation supposing the sewage to be so raised.

1149. (*Mr. Harrison.*) Whilst you were assistant surveyor upon the Aire and Calder was it your duty to look after the cleansing of the river in any way?—No; such men as the one who has given evidence today were principally instructed in those things, I had nothing to do with them.

1150. (*Chairman.*) Were you an assistant in the office?—Both in and out. About 10 or 11 years ago I took sections of the river throughout the full length.

1151. Do you know whether the bed of the river is being silted up?—I cannot speak to that, I can speak to there being black matter on the sides of the banks, but the water was much clearer at that time than it is now.

The witness withdrew.

Mr. William Statter (Wakefield) examined.

1152. (*Chairman.*) Are you a Fellow of the Royal College of Surgeons and in practice in Wakefield?—Yes.

1153. Have you been in Wakefield for any length of time?—I was born here, and have lived all my life here.

1154. Do you know the Wakefield Waterworks?—I am the chairman of the Wakefield Waterworks.

1155. Then of course you know the source of the water—the spring water and the river water?—Yes.

1156. Have you ever at any time considered the condition of the river from which you were getting your water?—It is a thing which we have often had to consider, and very seriously too.

1157. When you commenced your operations, I assume that the river was a very pure river, as compared to what it is at present?—Yes, it is nearly 30 years since the works were commenced.

1158. Do you think that if you had no works there you would place them where they are now, if you had to begin again?—I can hardly say; we should be puzzled where to go for water if we had to begin *de novo*, without going to a great distance and to a great expense.

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1159. Have you paid much attention to the mode of filtering?—Yes.

1160. Have you paid sufficient attention to be able to give an opinion whether the improvement in that respect has been beneficial in the way of health or otherwise?—I believe that the water now is very good water. It is purified by Spencer's process; that process, we believe removes, if not all, at least the greater portion of the organic matter, which is a great desideratum in our water. Unless we had met with Spencer's process I do not know what we should have done. I believe that we should have had to try to get water from some other source; but with this process we are now able to turn out the water very good.

1161. It comes out bright?—Bright and clear.

1162. And free from smell?—And free from smell or from any objectionable taste.

1163. I believe that you have had analyses made of it?—Yes.

1164. And I suppose that you have seen those analyses which have been put in by Mr. Sykes this morning?—Yes.

1165. There have been some attempts to negotiate a sale between the Corporation and yourselves, have there not?—Yes, twice, I think, we have attempted to agree.

1166. Do you think that it would be advisable for the corporation to become possessed of the works, or otherwise?—I have always expressed the opinion that it is desirable for the Corporation to possess the waterworks in any and every town. I think that for sanitary purposes the water ought to be in their possession; that is an opinion which I have expressed before, and which I still hold.

1167. Therefore, if reasonable terms could be come to between yourselves and the Corporation, you personally would not object to the transfer?—Certainly not.

1168. And then I assume that the Corporation or the inhabitants, if they wished for an altered supply might obtain it?—Just so.

1169. Have you heard of any schemes in the district for bringing in water from distant sources?—I have not.

1170. You have heard of Mr. Dale's scheme, I suppose, from Cumberland?—Everybody, I think, has heard of Mr. Dale's scheme; but it seemed to me so impracticable, that I never gave it much consideration.

1171. It does not seem to give you much uneasiness with regard to any rivalry which it may bring against your works?—Certainly not.

1172. What are the ordinary types of disease which you find most prevalent in Wakefield?—Fever, I think, is one of the most ordinary.

1173. Fever of what class?—Typhoid.

1174. In your opinion what does typhoid fever spring from?—I think from dirt as much as from anything.

1175. Dirt in the atmosphere, or in the habits?—Uncleanly habits and ill-ventilated houses.

1176. And bad feeding or low feeding?—Low feeding.

1177. Have you studied the principle of the carbide which is used for filtering the water?—Yes, I have paid a good deal of attention to it.

1178. What is your opinion of its mode of action?—I believe that it acts in this way: the water in passing through the carbide is burnt; the organic matter is burnt by a sort of process of combustion; it is decomposed by receiving a larger portion of oxygen, which burns it: that is the most expressive term which I can use. And we find that when the filters have been used for a week or ten days, they require to stand for a little while, and it appears as if the carbide so obtains back again from the atmosphere the excess of oxygen which it had parted with before. That seems to me to be some explanation of its mode of action.

1179. One can imagine that the carbide has a great capacity for oxygen in its pores?—Yes.

1180. And that it has a capacity for giving that out to any animal and vegetable matter in the water?—Yes.

1181. And that there must be an interval of idleness for the carbide to recover itself?—Yes. I do not think that that is exactly the way in which Mr. Spencer himself explains its *modus operandi*. He talks about its polarizing the water. I do not know exactly what that means. However, whatever may be the theoretical explanation of the process, there can be no doubt of its practical effect. We see the water going in black and dirty, and coming out freed from organic impurities.

1182. The water from the river I suppose differs very considerably at different times?—Yes, after a fresh of course it is better, after a long drought it is very bad.

1183. Mr. Sykes has told us that it was his endeavour to manage to pump water from the river at the time when it was least effected by the sources of pollution—that is to say during a fresh?—Those are the orders given to the man in charge of the works, namely, to take the water after a fresh.

1184. Still you would hardly think that that would bring two reservoirs full to the same state, the water would differ from time to time?—No doubt there would be a difference.

1185. Supposing that the water was particularly pure for the water of the Calder at any time then this carbide would have less to do?—Certainly.

1186. This carbide would not take out the whole of the organic matter?—No, but I believe that it very nearly takes it out, and what is left is very small.

1187. If I took samples of this water at one time, and found no great difference between the water which passed on to the filters, and the water which passed off, but that they were both comparatively very free from organic matter, that would be no proof that the material was not capable of purifying the water when it was impure?—No, it would simply mean that on that particular occasion there was less for the carbide to do.

1188. You, I suppose, saw the water when it was filtered through sand three years ago?—Yes.

1189. Was the water colourless after passing through the sand?—It was improved a good deal, but it was not as it has been since we have employed this process. The sand merely takes out what is held in mechanical suspension; it has no chemical effect.

1190. Judging as a mere matter of observation without chemistry, you say that when the water was filtered through sand it was still coloured?—It wa still slightly coloured.

1191. And after its filtration through the carbide its colour entirely ceased?—Yes.

1192. That in itself of course indicates an advantage?—Unquestionably.

1193. How long in practice is the carbide exposed to the air?—It varies. The surface of the sand itself is scraped once a week and of course during that process the water drains off and the air gets to the carbide.

1194. Before this process was adopted had you any reason to think that the water was injurious to the health of people who drank it?—I do not know the statistics—I have not them in my mind at present, and therefore I can hardly answer that question.

1195. (*Mr. Harrison.*) If I understand you rightly you say that whatever be the process you are clear in your own mind that there is a beneficial result from passing the water through this carbide?—Undoubtedly.

1196. What are the means which you have taken to determine that?—Analysis.

1197. Can you give us an analysis of the water before it went through the carbide filtering medium, and afterwards?—No, I think that we have not taken an analysis before, we have had the water analysed after the process.

1198. How can you show us that any improvement has taken place from the water passing through the carbide if you have taken no analysis of the water

before passing through the carbide?—We cannot give it to you in figures, but there is a very clear one from appearance—the result of a comparison of the two waters is very marked.

1199. Would you as a medical man think that the mere appearance of the water was a sufficient indication of its purity?—No, certainly not.

1200. Would you say that from the appearance of the water coming out, compared with the water going in and not appearing pure, you can from mere sight compare the two and gain a definite idea of their purity?—No, not from mere sight, but we know without sight that the sewage of this town and of many towns is poured into this water, and that the impurities of manufactures are likewise poured into it, and we know that the water does and must contain a large quantity of impurities—the exact amount, not having had the water analysed, we are unable to give you—we also know from analysis that after it has passed through this process those matters, whatever they may be, are absent.

1201. Do you consider that your carbide process improves the water to that extent that sewage matter passed into the river above Wakefield is altered and becomes non-mischievous?—I believe that the organic matter or sewage which is poured into the river is decomposed by this process and ceases to be mischievous.

1202. Do you not think that before you can expect us to take that as proved it would be well to have some analysis of the water before it gets in to the filter, and after it comes out?—It would be very desirable, and then you would have the exact quantities in figures; that could be done.

1203. You tell us that in passing through the carbide the organic matter is oxydized?—Yes.

1204. But we have nothing to show what quantity of organic matter goes in to be oxydized?—No, only that we know that it is considerable. My theoretical explanation may not be the correct one, but we only know by having water analyzed afterwards that the organic matter is absent.

1205. (*Professor Way.*) The water of the River Calder, if not affected by manufactories and towns, would, I suppose, be a good water?—Yes, it is a very good water.

1206. With a small quantity of solid contents of any sort?—Yes, comparatively small.

1207. Then I suppose it would depend very greatly upon the materials thrown into it and the opportunity of subsidence, and so on, how much matter of an injurious character was dissolved in the water?—Certainly.

1208. And that character would vary from time to time?—Yes.

1209. Have you made any observation upon the hardness of the water at the present time as compared with its hardness three or four years ago?—I think that it is about 9 degrees of hardness by Dr. Clarke's scale. I am not quite sure whether it was either less or more some time ago.

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1210. You do not think that the hardness varies much?—I think not much, except in flood time and then of course it must vary.

1211. Do you mean the river itself?—Yes.

1212. As I understand you, you take the water at flood time, so that it is just possible that your storage reservoir may contain water of a much less degree of hardness at times?—At times it may. We take it at flood time when there is a flood. When we have a three months' drought as we have had during the present year, then of course we must take it as it is.

1213. That was before the hay harvest?—Yes.

1214. It was a particularly dry time?—Yes.

1215. A good deal of rain fell in February and in the beginning of March, and after that we had a very dry time till the beginning of June?—Yes, or up to July.

1216. Do you think that 8 degrees of hardness is the natural hardness of the River Calder?—That I can scarcely say, as we have not analyzed very far back.

1217. You do not believe that the process of Mr. Spencer to which the water is subjected increases the hardness of the water materially?—I do not think that it does.

1218. I think that I am right in saying that he claims that it diminishes the hardness?—I think that he does.

1219. (*Chairman.*) Have you anything further to add?—Perhaps I might throw out a suggestion. If this process of Mr. Spencer's is as good as to us it appears to be, might not it be applied upon a larger scale along the whole course of the river? If we can purify the water of the Calder at Wakefield, could not the same process be applied to the dirty water sent into the river from manufactories? Could not it be required that the manufacturer should have a tank of this material through which to pass his dirty water?

1220. Then he must have a settling reservoir, as you have?—Yes.

1221. And filtering beds?—Yes, two filtering beds, so that one could recruit itself whilst the other was in use. I do not think that the process would be an expensive one, and I think that it is quite feasible to adopt something of that sort, and if it was done I think that you would solve the problem of purifying the river without interfering with the manufactories.

The witness withdrew.

Adjourned to to-morrow at 11 o'clock.

Wakefield, Thursday, 18th October 1866.

PRESENT:

ROBERT RAWLINSON, ESQ., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, Esq. | Professor JOHN THOMAS WAY.

Mr. GEORGE SMITH (Wakefield) examined.

Mr. G. Smith.
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1222. (*Chairman.*) What are you?—I am captain of one of the dredgers.

1223. Under the Aire and Calder Navigation Company?—Yes.

1224. How long have you been employed under the Aire and Calder Navigation Company?—Nearly 30 years altogether; I have been 23 years with dredgers, one and another.

1225. Of what power is your dredger boat?—The engine is about 9-horse power.

1226. What quantity of material can you dredge up in an hour?—A weight of 100 tons. We can dredge 50 tons in half an hour.

1227. In what part of the navigation are you principally engaged?—For the biggest part of my time I am between Leeds and Goole, and up to Wakefield.

1228. That is below Leeds?—Yes. In the last two years I have been for the biggest part of my time above Wakefield.

1229. On the navigation?—On the navigation.

1230. Not on the river?—On the river and canals together.

1231. In what state do you find the river and canals now as compared with what they were when you

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began 23 years ago?—They are in a far worse state at present than they were 23 years ago.

1232. Have you to lift more material now than you did 23 years ago?—We used to work the dredger regularly 5 or 6 months, and then to lie by having nothing to do, but now we have continually to dredge.

1233. Are you entirely in charge of your boat, or are you working under any other person?—I have the entire charge of it.

1234. Are you under Mr. William Holmes?—No.

1235. Then Mr. Holmes is captain of No. 1?—Yes.

1236. And you are captain of No. 2?—Yes.

1237. How many men have you under you?—I have four on the dredger.

1238. And how many in your lighters?—I have 19 altogether when I am full-handed, but we are two short; 20 men including myself is the complement.

1239. How many lighters have you?—Five.

1240. What do they carry?—About 50 tons each.

1241. What depth of water do they draw?—4 ft., and 3 ft. 9 inches.

1242. What does your dredger draw?—About 4 ft.

1243. To what depth do you lower your buckets?—About 9 ft.; 9 ft. 6 in. is a full depth.

1244. In your dredging operations have you seen any carcases of dead animals floating past you?—I saw one this morning floating by the dredger, and I see them regularly. I saw one yesterday floating by, and in my time I should think that I have seen scores of dogs and cats, and even pigs and sheep.

1245. Floating on the surface of the water?—Yes.

1246. In what condition is the stuff which comes out of the river now, as compared with what it was formerly, as regards smell?—It sometimes smells very badly, so that you can hardly abide near it; that is owing to the dye stuff, and the sewage from the main sewers which runs into the river.

1247. And refuse from chemical works?—Yes, and chemical works too.

1248. Do you sell the material which you dredge?—Sometimes; when we can we sell it for grass land, but we cannot sell much of it now.

1249. Do you dredge any gravel or sand which is worth anything?—Yes, we have sold some at different times, but the river has now got so full of rubbish that we can scarcely dredge any sand; it is full of engine ashes and refuse of all sorts. The biggest part of our dredgings now in the river is engine ashes and dyewood.

1250. Spent logwood?—Yes.

1251. Do you find any bark refuse; any oak bark?—Sometimes a little, but we have a deal of dyewood—logwood which has come away from the dyeworks.

1252. Do you know whether the Aire and Calder Company have ever attempted to stop the pouring of this refuse into the river?—I believe that they have been about stopping it, but I do not know whether they have tried or it not.

1253. Do you every year have more to dredge for the purpose of keeping the river in order?—Yes, we have had more every year; the river has been getting worse these 23 years.

1254. Do boats which are navigating the canal and the river ever stick upon the banks which you have to dredge away?—Yes, even last summer above Wakefield.

1255. Have the men had to load the boats, or lighten them, in order to get them off?—Yes, they lighten some, and some of the boats stop till the water rises and they can float off.

1256. Do you think the floods are greater now than they were, or less?—I think that they are rather less on the average than they were 20 years ago.

1257. To what height will a flood rise from low water to the highest flood which you have known?—I do not think that it rises much above 6 ft. now in the regular way; it might sometimes get as high as 7 ft., but I think it has not done so lately.

1258. Is a great deal of material washed in from the sides of the banks?—A little washes in from the sides of the banks.

1259. Do the banks slip more at any particular part than at another?—At some parts they slip in and a little of the soil washes into the river.

1260. Then you have to dredge that out?—Yes, the material washes into the sand.

1261. Do you at all repair the banks, or have the Aire and Calder Company any men who repair the banks?—Yes; the bank is repaired, and when it slips in stone is put to prevent the slipping.

1262. Do the men put piling as well?—Yes, piling if required—but rubble stone if it will do.

1263. Do you think that you have less water in dry weather than you used to have?—I cannot speak to that point, but last summer and the previous summer we had less water than I ever knew since I belonged to the company; in 1865 the river was lower than I ever recollect it.

1264. After these heavy floods do you find the bed of the river in a better or in a worse condition than it was before?—When a flood comes it clears the bank out, but a bank will form there again exactly in the same way.

1265. Have you to go there and dredge again?—Yes.

1266. And that process goes on continuously?—Yes.

1267. If you did not dredge what would become of the river?—It would lay up, so that the boats could not go at all; the bed of it would rise up out of the water.

1268. And there could not be any navigation?—There could not be any.

1269. I suppose that if the floods were prevented this inequality would not take place to so great an extent, you could navigate longer?—Yes, but when there are no floods at all the matter keeps accumulating.

1270. If any person told you that the floods improved the river, what would you say to him?—I should say that they did not do so, but that they were an injury. In some places where the river is rather narrow floods sluice it out the waterway a little, but in wide places the refuse all settles—what comes from the dyeworks and refuse of all kinds; ashes are the worst thing, and the dyewood and logwood.

1271. Do you know at what part of the navigation or river ashes are mostly thrown in?—Before there were mills up above Wakefield the water came down quite bright and clear; we could use it on board the dredger for tea water, but it is now full of all sorts of rubbish, and we cannot use it at all; it is not fit for use.

1272. Do you find that the water acts at all upon the iron work of the dredger boat, so as to rust it?—No; I believe that the biggest part of what comes into the river comes from mills.

1273. Is there any of the material which affects the shoes of the men when they are working among it?—Yes, the material from the chemical works.

1274. And does not that chemical refuse affect the iron and the timber?—At Leeds, when we have been working alongside chemical works, I have seen the stuff stick to the boat's side.

1275. What effect has the refuse from chemical works upon the men's shoes or boots?—It destroys them.

1276. It rots them?—Yes, or burns them, or something like that.

1277. Were there any fish in the river when you first came upon it?—This river and the other were full of fish, but you cannot now see any; the water has killed them.

1278. (*Mr. Harrison.*) Do you send in a regular return every day or every week of the quantity of stuff which you dredge?—I send down every week a statement of the quantity which we dredge.

1279. And you have done so all the years that you have been the captain of the boat?—Yes.

1280. So that from the office at Leeds we could get a return showing the gradual accumulation of

stuff in the river?—Yes, from the commencement, and I do not doubt that you will find it about three times as much now as it was at the commencement.

1281. (*Chairman.*) Have you any complaints made, or do you hear any complaints from the landholders or persons living on the sides of the river as to the condition in which the water is now?—I do not know that I have had any complaints.

1282. Have you had any complaints that the cattle would not drink the water?—Yes, I have heard that; that it was not fit for them.

1283. Do you ever see them drinking it?—I have seen them drink it but not lately. I have not been lately where there have been any cattle by the river.

1284. When you are dredging in the summer below Leeds, do you ever see persons bathing in the water?—Yes, I have seen them many times.

1285. In the dirty water?—Yes.

1286. (*Mr. Harrison.*) Do they get clean by bathing in it?—I cannot tell you whether they do or not, but it really is not fit to wash in. I have had to wash myself in it when I could not get any other water, but it is not fit.

1287. (*Professor Way.*) Whether it washes a person cleaner depends, I suppose, upon how dirty the person is?—It would not wash any person clean.

1288. (*Chairman.*) Do your men ever bathe in the water?—No, and I should not like to bathe in it.

1289. (*Mr. Harrison.*) Is dredging ever carried on above Leeds and above Wakefield?—Yes, it has been carried on this summer.

1290. Above Leeds and above Wakefield too?—Yes.

1291. Who manages that?—I dredged at Thorne's Lane, near here, this summer.

1292. How near with your dredge can you go?—I have been up to Mirfield.

1293. How far is that above Wakefield?—Eleven miles.

1294. Do you find that you dredge much from that part of the river?—Yes, at Greenwood Pond I have dredged hundreds of tons, and the river was laid up again with logwood and engine ashes; it is so bad that they cannot get the boats near to it at present, although the boats draw only four feet.

1295. Is there any other boat than yours?—Yes, there is a small one; the men first went with that small boat and dredged it, and I have since dredged it; that part has been dredged four times that I know of in these two years, and how many other times I do not know; I have dredged it three times and I know that the other dredger has dredged it once.

1296. Do you dredge above Leeds as well?—I have not been at Leeds these two years. No. 1 dredger has been there this summer.

1297. (*Chairman.*) When dead carcases come floating down, do you take them out of the water?—We have taken some out and buried them.

1298. Why did you take them out, was it because they annoyed you?—To get them out of the water.

1299. Were you told to take them out?—No.

1300. Have you any special order from the office to take them out when you see them?—No.

1301. Then you simply took them out because they came in your way, and you thought it better to take them away?—Yes.

1302. Supposing that a special order came down to take every one of them out and bury them, would it be much for you to do?—No.

1303. Where do you deposit the material which you have dredged?—We wheel it on to the banks and we put it over the weir; there is a wide place there and some stone work, and we put it to the back of the stone.

1304. You narrow the river at those points?—Yes, so that it will not lay up any more.

1305. What is the longest distance which you take the material by towing it?—We take some half a mile, and some a mile, and some three or four miles.

1306. Have you a little steamer, or do you do the work by horses?—By horses.

1307. And you discharge the material by hand?—Yes.

1308. Is payment made by day wages, or by measurement?—By measurement.

1309. How much a yard do you get for it?—4*d.*

1310. Is a yard considered a ton?—Some of it will weigh above a ton, it depends upon what it is; some of the stuff is very light and some very heavy.

1311. Then you measure it, and do not take the weight?—No, we estimate it only by measurement; sometimes the price is 4*d.* a yard, and in others it is less, namely 3*d.* a yard, it depends upon the distance that the material has to be wheeled.

1312. What does it cost a yard to dredge it and lift it?—There are five of us, viz., four men, three at 3*s.*, and one at 3*s.* 4*d.* a day, and I have 3*s.* 6*d.*

1313. How much coal does it take?—We can work with about 1½ tons or 2 tons in a week.

1314. At what particular points do you find the most ashes to dredge out?—In wide parts of the river; there is Thorne's Lane.

1315. Where is Thorne's Lane?—At the upper side of Wakefield Dam.

1316. Opposite whose premises is it?—Mr. Holdsworth's and Mr. Mackie's corn warehouse.

1317. (*Mr. Harrison.*) The places where you have this large quantity of ashes and different things to dredge out of the river have nothing to do with the manufactures near the river?—No.

1318. They are formed by the shape of the river?—Yes.

1319. You always find the deposits in the same place?—Yes.

1320. They may have come down for miles from above?—Yes.

1321. You do not necessarily ascribe them to the manufacturers in the immediate neighbourhood?—No.

1322. (*Chairman.*) The ashes may have come down 10 or 12 miles?—Yes.

1323. (*Professor Way.*) In a flood?—Yes.

1324. (*Mr. Harrison.*) Are there any places on the river where you have observed large quantities of ashes and dirt and refuse tipped into the river to be washed away?—I have seen ashes tipped in at some dyeworks half a mile below Horbury Bridge.

1325. (*Chairman.*) From the dyeworks furnace?—Yes, down the bank.

1326. Have you power to stop persons from doing so?—The bank-walker up there had orders to discharge all persons who tipped in the ashes.

1327. How could he discharge them?—He was the head man over that navigation; he was the foreman of the men who repaired the banks and the towing-paths, and he had to look to see that no damage was done to the navigation.

1328. How could he interfere with the men who were working for the dyer?—He could go to the dyeworks and charge them not to tip into the river.

1329. He could tell them not to do it?—Yes.

1330. He could not go and turn off the man from the dyeworks?—No.

1331. He could only tell them not to tip in any more ashes?—Yes.

1332. Would they pay any attention to him?—I cannot say.

1333. Do you not think that they would do it again when he turned his back?—I do not doubt that they would if they had a chance.

1334. Did you ever hear of their being summoned before the magistrates for doing it?—No. A mile and a half or two miles below Horbury Bridge, at Lupsett Pond, that is above Wakefield, there a shoal rises up which principally consists of ashes and dyewood which has been washed down, causing boats to ground for 24 hours at a time; this never rose up before the last five or six years.

The witness withdrew.

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Mr. Joseph Barker, of the firm of R. H. Barker and Co., Thorne's Mill, Wakefield, examined.

1335. (*Chairman.*) Are you in business in Wakefield as a worsted manufacturer?—I am.

1336. Your works are situated on the edge of the river?—Yes.

1337. Do you use much of the water?—We use no other water than that from the river.

1338. For what length of time have you had your works there?—30 years.

1339. In what condition is the river as compared with what it was when you commenced?—Very dirty indeed; it is very bad now.

1340. Worse than it was formerly?—Much.

1341. Is it at all prejudicial to your manufactures?—It is very injurious to our working our engine; it is very detrimental to the work.

1342. Do you use the water for washing or dyeing?—For both.

1343. Do you find it worse for washing and dyeing than formerly?—Much worse.

1344. Are you put to any inconvenience by this foul condition of the water?—Yes, decidedly so. We have a difficulty in getting our colours. We are obliged to do the best we can, but we do not succeed so well in our colours in dyeing as we used to do.

1345. Have you had to cease dyeing any special colours in consequence of the condition of the water?—Yes, we do not dye some colours now; we send the goods to Halifax to be dyed there. We should dye those colours if our water was more pure.

1346. What colours are those?—More especially magenta colours and the scarlets. We do dye the scarlets in the raw kind of goods, but the better kinds we send to Halifax. It is the same with any particular colour.

1347. Where do the Halifax dyers get their water from?—I do not know. We are not dyers; we merely dye for ourselves. We are worsted manufacturers, we are not special dyers.

1348. Do you use any of the waterworks water for your washing or dyeing purposes?—No; it is rather expensive for one thing, and it is at some distance; it does not come quite so far as we are.

1349. Do you use engine power?—Yes.

1350. What do you do with the ashes?—We stow them away on the banks of the river, and cart them away wherever we can find a place for them.

1351. Do any of them get into the river?—No, we send nothing into the river but the refuse from scouring wool and worsted. We do not turn any dye stuff of any kind into the river, spent woods or anything of that sort.

1352. Have you considered whether it would be an advantage to have the river put under some jurisdiction, so that persons above you should be compelled to abuse the water less than they do now?—It would be very desirable indeed for all parties if some plan could be adopted to prevent the river being fouled as it is now fouled.

1353. I presume that you would much rather have clean than dirty water?—Yes.

1354. And I suppose that it would be the same with other persons similarly situated to yourself?—No doubt of it.

1355. Is there any form of refuse from your works in the shape of waste wool material, or any other form of refuse which you now pass into the river?—After washing, the soapsuds and things of that sort go into the river, but that is all. No solid substance goes away; the refuse is all in a liquid state.

1356. What weight of soap do you use in a month or a year?—Four tons per month.

1357. Have you your soapsuds chemically treated?—Yes, but only a part of them. We have not so treated the water which has washed the wool, but the water in which we wash our worsted is treated in that way.

1358. The wash-water is sold?—A part of it is sold to Messrs. Teall and Company, the other part has so much water that it is not worth his while to take the greasy matter from it.

1359. And it goes into the river?—It goes into the river altogether.

1360. Do you use any indigo?—Yes.

1361. Is any of your waste indigo recovered?—No; it is run off into the river when the vat is spent and finished.

1362. Are you aware that Messrs. Teall and Company are working a patent for the recovery of waste indigo?—I was not aware of it.

1363. What weight of indigo do you use in a year?—About 500 or 600 lbs. weight a month.

1364. And the whole of that is wasted so far as the worsted does not take it up?—Yes, perhaps we use more indigo than that.

1365. Have you any idea what weight out of the 500 lbs. a month is taken up by the worsted?—I have not.

1366. Do you think that you get 100 lbs. a month in the worsted?—I should think not.

1367. Or 50lbs.?—I do not know.

1368. But I suppose you are aware that the worsted only takes up a very small proportion of the weight of indigo?—I should say so.

1369. And a large per-centage goes away from you? Yes.

1370. If that could be recovered cheaply you would not object to recover it?—I should not. But Messrs. Teall and Company could not get the indigo from our goods at all.

1371. (*Professor Way.*) Then you do not wash your indigo-dyed goods?—Yes, we wash them, but the worsted manufacture is a different process altogether from that which is adopted with cloth; worsted does not absorb the quantity of indigo at all which cloth would.

1372. (*Chairman.*) What number of persons, including men, women, and children, do you employ upon your works?—About 200 altogether.

1373. Have you open privies for them, or waterclosets?—Waterclosets.

1374. Do they drain into the river?—Yes.

1375. Have you tried any system of sewage utilization, by working a tank?—No; we had the open privies, but the smell was so bad that we adopted the watercloset system.

1376. (*Mr. Harrison.*) Can you give us the quantity of water which you use in the different processes of cleansing the wool?—No.

1377. Or about the quantity?—90,000 to 100,000 gallons per day.

1378. (*Chairman.*) Is it pumped by steam power?—Yes.

1379. Do you know the size of your pump?—No. We have no scarcity of water; we have plenty of water.

1380. Do you know whether the river has altered as regards the volume of water since you knew it—have you less water in dry weather?—I think that we have less water in dry weather.

1381. And more in floods, or less in floods?—About the same quantity in floods; we have often floods in a wet season.

1382. What height is the base of your works above the summer level of the river?—Eight feet.

1383. Are you ever flooded?—We get a little backwater sometimes in the engine place during a flood.

1384. You are sometimes inconvenienced by floods?—Yes, a little, but not a great deal; it is not often that that is the case.

1385. (*Mr. Harrison.*) Have not considerable works been carried out in the upper parts of the river in the formation of reservoirs to collect the water, which would flow down as flood water?—I believe that there are reservoirs of that sort, but we have none about here.

1386. Is not the object of those reservoirs to collect the water which would pass off as flood water to let it down more regularly during the summer season?—Yes, and I should think it very desirable.

1387. You would expect the effect of that to be,

that the floods would be less, and the summer supply greater than formerly?—Yes.

1388. But you have not observed that effect?—No, the river is very low now in dry seasons.

1389. (*Chairman.*) But however low it is it never interferes with your getting the volume of water you want?—No. Whenever it is low in a very dry season, the water is not so good, and we have a great stench from the river.

1390. In a dry season you have less water?—Yes.

1391. And it is more impure?—Yes.

1392. And a great stench comes from it?—Occasionally it is very offensive.

1393. Does the smell at all interfere with the health of your people?—I do not know that I could say that; it is exceedingly disagreeable, but I am not aware that it has had any effect of that sort.

1394. (*Mr. Harrison.*) If I understand you, in the cleaning of your yarn you do not collect any of the suds to send to Messrs. Teall's works?—Yes; after washing all our worsteds and yarns, the refuse water goes to Messrs. Teall's; it is otherwise with the washings from the wool, because with the wool we use a great quantity of water, and it is not worth Messrs. Teall's while to take it.

1395. Do you wash it in a machine as they do in many of the manufactories above?—Yes, we wash it in a patent machine.

1396. Is not the wool with the machine cleaned with a minimum quantity of water?—No, there is a large quantity of water with the wool, much larger than used to be the case; we used to wash it in a small vessel by hand, but we can now wash it much more and we do so in a large quantity of water.

1397. Could not the water which had been used to complete the process of the last batch of wool be used for taking away the oily matter from the succeeding batch?—No; since we have had an agreement with Messrs. Teall and Company of course they do as they please with the suds, they either take them or not.

1398. Do you receive money from Messrs. Teall for the suds which they have from you?—Yes, they pay us so much a ton for every ton which they get from us.

1399. If it should be proved to us in the course of our inquiry that, without an actual expense to you, you could extract the soap refuse from the remainder of the water which you use in washing, would it be any hardship to require that you should do it?—We have nothing to do with the greasy matter at all, we do not care about it.

1400. You receive a sum of money for a certain part of it which is rich in grease?—Yes.

1401. If you could, without receiving any money but without expense to yourself, separate the grease from the remainder, would it be any hardship to require you to do so?—I do not quite understand you.

1402. (*Chairman.*) Supposing that the law should be so altered that you were prevented from passing any refuse grease into the river, and that you would not receive so much from Messrs. Teall and Company as you do now, would it be a hardship if you were not allowed at the same time to make the largest profit which you could with one part of your refuse water, and to contaminate the river with the remainder?—It would be a hardship to the extent of 100*l.* a year. We at one time used to get 200*l.* a year from Messrs. Teall, but the large quantity of wool which we scour is not affected at all by their process now; they say that it is not worth their while to take the wool water, and therefore we receive no money for the largest quantity of material which we wash.

1403. You say that you get an income from a certain portion of the waste refuse which pays a person to take it away?—Yes.

1404. But if the law said to you, "You shall not put any of it into the river, whether you get an income or not, and the same rule enforced against all manufacturers alike," do you think, from the purified condition of the water, you would get an equivalent for that portion of the profit which you in common with all the manufacturers on the river would thus forego?—I should be very glad to forego that portion of the profit in order to have the whole of the river purified.

1405. That is a very important admission, because you see that the probability is that if the river is to be purified it may cost money, and the cost of the purification must come upon the persons benefited?—Certainly.

1406. (*Mr. Harrison.*) The refuse from your cleansing processes is rich to a certain extent, so that you can actually sell it to Messrs. Teall, and they will give you money for it?—Yes.

1407. But there is a large quantity of fluid which passes away besides that, which he says it will not pay him to give you any money for, but which might be reclaimed without being any actual expense to you in the result?—Certainly.

1408. (*Chairman.*) Messrs. Teall and Company might say, We will give you 100*l.* a year and will select the portion which we will take, or they might say We will take it all if you will let us have it for nothing?—Yes.

1409. (*Professor Way.*) What is the nature of the injury which the river water does to your dyed goods?—It makes it more difficult to dye delicate colours.

1410. The colours are not so bright and fresh?—They are not so bright, and it is difficult to hit off the particular colour.

1411. Is that due to matters suspended in the water? If the water were filtered would it be better for the purpose?—It would be better.

1412. Is not the presence of sulphur in the water a difficulty in the working of some of your dyes?—Yes.

1413. With the magenta dyes for instance, and the scarlet?—Yes.

1414. And whether water was filtered or not you would have that?—Yes. The water at Wakefield used to be particularly good, and was considered very excellent water for dyeing.

1415. The effect of the impurity of the water is that the delicate dyeing processes are being carried out further up stream?—Yes, the water now comes to us in a very dirty, muddy, bad state.

1416. What materials do you use in dyeing?—Dyewoods, logwoods, fustic.

1417. Salts of iron?—Very little.

1418. And of tin?—Yes, a little.

1419. Which you dissolve yourselves?—Yes, we make the dye for our own goods.

1420. I suppose that it is restricted to certain colours?—Yes.

1421. What colours are they?—Blues, blacks, scarlets, and purples.

1422. Still there are many colours which you do not dye?—Yes.

1423. You do not use so great a quantity of dye materials as other persons use?—No.

1424. Are the vats, for instance the logwood vats, often emptied?—The logwood vats are emptied every time that the dyeing is done; indigo vats, of course, last some time till the indigo is spent.

1425. When the logwood vats are turned out, what colour is the liquid? Is it very dark?—Yes.

1426. Does it make an appearance in the river when it goes in?—Yes.

1427. Does the river become darker?—Yes, there is a stream of blue.

1428. (*Chairman.*) Did you ever try any mode of filtering the refuse?—No.

1429. Are you aware that any person in the neighbourhood has tried it?—I am not.

1430. (*Professor Way.*) Logwood water is really a transparent liquid when it is run off, is it not?—No.

1431. But the colour is in the liquid?—Yes.

1432. Therefore, if you were to filter it by ordinary filtration the colour would still remain?—Yes.

1433. The refuse of the logwood itself I suppose is dug out of the vat?—Yes.

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1434. Is that thrown into the river?—No; we do not throw anything of that sort into the river, it is laid away somewhere wherever we can get it away.

1435. (*Mr. Harrison.*) Is it large in quantity?—It is not.

1436. You heard the evidence of the last witness as to its being dredged from the river by the Aire and Calder Navigation Company?—Yes.

1437. (*Professor Way.*) After it had been laid up for a little time you could burn it in your fires?—Yes.

1438. In your works, supposing it to be desirable to have tanks for the purification of your liquid before its discharge into the river, have you space to make such tanks?—I daresay that we could do so, but we are not very well off for that kind of thing; it could be done however.

1439. The buildings, as a rule, are above ground, are they not?—Yes.

1440. You have no underground places?—No.

1441. Supposing that you were pressed for room, would there be a possibility of making tanks under the buildings?—Yes, we could make tanks well enough; it is a matter of expense.

1442. Do you think that that is generally the case with woollen works?—I should think so about here. There are no underground works, or anything of that sort.

1443. I suppose that you have men about your works who would be quite competent to look after any little simple process of that kind?—Quite so.

1444. (*Chairman.*) Have you any further remarks to offer?—No, I do not know that I have. I shall be very much delighted if you can establish a better mode of getting water for us.

The witness withdrew.

Mr. J. D. Goldthorpe.

Mr. John D. Goldthorpe (Wakefield) examined.

1445. (*Chairman.*) In what business are you engaged?—I am a worsted and woollen yarn spinner.

1446. Your business is similar to that of the last witness?—Yes.

1447. Where are your works situated?—In Ings Road.

1448. On Ings Beck?—At some distance from it, but we get our water from there for engine purposes.

1449. How far are you from the edge of the Calder?—About a mile.

1450. What number of persons do you employ?—Between 70 and 80, but we are increasing the works.

1451. Do you dye?—Yes.

1452. And wash?—Yes.

1453. You use soap?—Yes.

1454. Do you treat your soapsuds in any way?—The refuse all goes into the Calder at present.

1455. You do not sell any of it?—No. We have not been able yet to put up apparatus to deal with it.

1456. Is the refuse as rich as that portion of the refuse from Mr. Barker's works, which is dealt with by Mr. Teall?—Yes. It is not only the soap refuse which Mr. Teall cares about, but the oil as well.

1457. Do you get water for washing from any other source than the beck?—We get our water for washing from the waterworks company.

1458. What volume do you get per day?—I cannot tell you exactly what volume of water we get per day for washing alone, we use about 5,000 gallons a day for washing and dyeing; we have sunk a well, and we pump up the water and use it partly for dyeing.

1459. What depth is your well?—About 10 yards. It is a very hard water.

1460. Has it any iron in it?—It is full of iron.

1461. Then it is injurious for dyeing?—It will do for some colours, and not for others; it will do for blacks, and not for browns.

1462. What do you pay per 1,000 gallons for your water?—The waterworks company have a sliding scale. Sometimes it is 10*d.* per 1,000 gallons that we pay, and sometimes 9*d.*, and sometimes 1*s.*

1463. How long have you used the company's water?—For some years.

1464. Is it any better or worse than it used to be?—It is not any softer than it used to be; it is harder, if anything.

1465. Is it as bright, or brighter?—It is quite as bright.

1466. Is it at all different in its character from what it was some two or three years ago?—I think that it is brighter.

1467. Do you know that there is a fresh method of filtering it?—From report, that is all.

1468. Have you found any benefit from it?—I have not paid sufficient attention to say.

1469. You do not know whether it does or not affect any of your dyeing products?—I have not found any difference.

1470. Have you begun to use a larger volume of water since the new system of filtration has been in operation?—Decidedly not. We used to pay so much a year without any meter, and it is only within the last year or two that we have taken water by meter. We formerly paid 20*l.* a year.

1471. How much do you pay now?—We paid about 50*l.* the year before last, and not quite so much this last year, because we sank a well.

1472. How long have your works been situated on this beck?—More than 20 years. Since 1838.

1473. Has the water altered in its character since you began to use it?—I do not think that it has; that is to say, the water from the beck.

1474. What is situated above you?—There is a dam.

1475. Are there any works above you?—Yes, Marriott's works.

1476. What are they?—Messrs. Marriott are worsted spinners and dyers, the same as ourselves. They turn in their refuse down below the dam, and we have been in the habit for years of using the refuse water from the dye-house for our engine.

1477. Are there any other works above you?—Yes. There are some more, but they only turn down the refuse once a week; they have tanks. Messrs. Moorhouse and others up at Alverthorpe turn down the dye-water and the water of their houses on the Saturday night.

1478. Is that an advantage to you or a disadvantage?—We do not consider the dyewood and the other things in the water any disadvantage, so far as regards our boilers and engine.

1479. But as regards washing, what is the case?—We do not use the river water for washing at all, but we use the waterworks water.

1480. (*Mr. Harrison.*) Why do you not find it any disadvantage as regards the boilers?—The chemical products which are in the water, and other things, prevent the deposit of the sulphate of lime.

1481. (*Chairman.*) Is it a very hard water?—Yes, it comes from the coal pits.

1482. (*Professor Way.*) The hardness is a permanent hardness; you may boil the water as much as you like without affecting it?—Yes.

1483. (*Chairman.*) What is your opinion as to placing manufactories under some kind of superintendence, so that you should be prevented from fouling the streams?—I suppose that we should be troubled just the same as we are by the factory inspectors, who come round once in three or four years. I do not care, because we are always right.

1484. (*Mr. Harrison.*) But although they only come once in three or four years, is the result satisfactory?—Yes.

1485. (*Chairman.*) There is a liability that they may come at any time?—Yes, there is no doubt about that.

1486. You know the condition of the Aire and Calder ?—I do.

1487. And you know the condition of the waters of Yorkshire generally ?—I think it is much better down here than when you get up to about Elland and Brighouse, and those parts, I have seen the river there in an awful state.

1488. Do you think it is possible that can go on without alteration, the manufactures increasing ?—I do not think it can ; it would be a very good thing to keep all refuse out of the river, and to compel each manufacturer to provide tanks to utilize the refuse water.

1489. Do you think that the manufacturers in consequence being left to themselves are really destroying the water which is for the whole of the public ?—I have no doubt about it.

1490. Do you think that something should be done to stop that, and that all should be placed under the same restrictions ?—I am quite of that opinion. I think that we want more central government in this country, and that we incline too much to a local and municipal government.

1491. Then if a way can be shown by which the manufacturers should be so far controlled that they should not pollute the streams, and yet that they should be enabled to carry on their trade with profit and advantage, you would not consider such control a hardship ?—Not at all ; if all we manufacturers were put on the same footing we should get it out of the public in the end.

1492. Have you ever seen places where ashes are thrown in ?—No ; I have only heard tell of one place in Wakefield where they have been thrown into the river.

1493. Where was that ?—They used to send them into the river from Holdsworth's dye-house, I have heard the workmen say so.

1494. Do you know that in other parts of Yorkshire the men of the mills standing on the side of the river never move a spade full excepting into the water ?—I have not that knowledge, but I fancy that they would do such things if left alone ; but here we have a very great demand for ashes, and there are two or three boats always ready to fetch them.

1495. Are you a member of the town council ?—No.

1496. Have you ever been so ?—Yes.

1497. How is the local business managed by the town council ?—I can hardly tell you. I have had nothing to do with it for six years.

1498. Have you much carting to do from your works down to the railway or into the town ?—Fairly, the railway company cart the articles.

1499. (*Mr. Harrison.*) When did you sink your well ?—About 18 months ago.

1500. Before that time did you receive all the water from the waterworks which you used for dying and cleansing the cloth ?—Yes.

1501. What quantity did you use then ?—I can hardly tell you, but I know that in the half year it came under the price of 9*d.* a 1,000 gallons.

1502. What total quantity would that imply ?—About half a million gallons in the half year.

1503. Can you give us the weight of wool, and so forth, which you would wash in a day ?—We took part of the water for dyeing as well ; I could not tell you the quantity of wool which we washed with it.

1504. (*Chairman.*) Do you know the weight of wool which you use in a year ?—We are using something like 25 packs of wool every week.

1505. Of what weight is a pack ?—240lbs.

1506. Did you hear a gentleman's evidence yesterday with regard to the amount of potash which is got out of wool ?—I know that it is quite possible, because I have seen the operation performed, but the same quantity cannot be got out of the wool used in this district, because the wool comes already washed ; it is nearly all skin wool, or foreign wools such as Russian or East Indian wools, which come dried and packed very hard.

1507. (*Mr. Harrison.*) Do you use a machine in washing your wool ?—Yes.

1508. What quantity of water do you use to a certain quantity of wool ?—That I cannot tell you.

1509. (*Chairman.*) The waste water is run into the beck ?—It goes into the beck ; I do not know but what it might be utilized, but it would be at some cost. The wool might be washed twice through, and what you finish the last with might be used to wash the next batch. But I fancy that the reason why it is not worth Messrs. Teall's while to take it is, that we are making our own soap for washing wool, and we make it with a much stronger alkali, and with less grease than is poured in soap which we should buy.

1510. (*Professor Way.*) As they do not get the alkali out of it, but only the grease, it is not so profitable to them ?—No.

1511. (*Chairman.*) It is an economy to you to use that kind of soap rather than to use the soap of commerce ?—Yes.

1512. What weight of that soap which you make do you use in a year ?—In making the soap we use about four tons of grease in a year, and we should use about four tons of soda ash to it.

1513. Messrs. Teall and Company say that that grease when recovered is worth about 18*l.* a ton ?—Yes ; the grease which we use now is grease which has been used by curriers.

1514. The waste dubbin ?—Yes.

1515. It serves your purpose ?—Yes, very well.

1516. What is it worth in that condition ?—About 30*l.* a ton.

1517. And what is new grease worth a ton ?—I should think about 47*l.* or 50*l.*

1518. (*Professor Way.*) I suppose that you could not form a notion, as Messrs. Teall do not buy your refuse, what proportion of the grease is saved ?—So far as I can understand from Messrs. Teall, having had talk with them at different times, I should say that every portion of the grease could be got out of any soapsuds if you only put acids in to recover it.

1519. (*Chairman.*) And if you use the means which they describe ?—Yes.

1520. Have you seen their presses at work ?—Yes, several times.

1521. It would not pay you individually to do it at your own works ?—No, I do not think that it would, but that I am not exactly in a position to state.

1522. (*Mr. Harrison.*) But you agree with the last witness, that if you could do it without extra expense to yourself, it would be quite fair to ask you to do it, inasmuch as your throwing it into the river is a nuisance to others ?—There is no doubt about it, because I do not believe that anyone has a right to create a nuisance against his neighbour.

1523. (*Chairman.*) But still it would be useless to ask you or any person individually, or Wakefield separately, to submit to restrictions, supposing that all of you gentlemen in Wakefield were compelled by your local government to do certain things; if the rest of Yorkshire did not follow suit you would be at a disadvantage ?—Of course.

1524. And the probability is that the restriction would destroy the manufacture in this particular place ?—Certainly.

1525. (*Professor Way.*) The chairman asked you what would be the result if this state of things went on for some years longer, supposing the dyeworks and the works which pollute the river to increase. Would a point come at which no further work could be done simply because there were no means of doing it ?—I cannot see that exactly. We could not do the work that we do now if we took the water from the river in its present form; but if the chemist stepped in with his carbide of iron, and so on, we could use the river water.

1526. You spoke of Messrs. Moorhouse as manufacturers above you ?—Yes, they do not use very much water, but they retain their refuse, and it comes down on Saturday night.

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1527. Are their tanks large?—No, not very large ones.

1528. Therefore, if there were a necessity for retaining the wash water for a time, it would not be so difficult to do it?—No. Why those people up the stream are obliged to keep the refuse till Saturday night is, lest it should foul the water at a dam belonging to Mr. Hick and Mr. Marriott.

1529. The refuse water being passed on Saturday evening then, the river is clean again on Monday?—Yes.

1530. You know most of the works in this neighbourhood?—Yes.

1531. Are they so situated that it would be possible in the majority of cases to connect them together so as to deal with their refuse at one spot?—I have not the slightest doubt about it; they all now can go into the common sewer which has been made.

1532. There could be a pipe from one to the other, and the refuse could be dealt with as one quantity?—Yes, they are not above a quarter of a mile apart; they lie in a circle of half a mile I should say.

1533. And I suppose that the machinery which you could put up, and the arrangements which you could make, could be more economically effected for the whole than for one individual?—Do you mean dealing with the soapsuds?

1534. Yes.—No; you could deal more economically at each manufactory, because you would have the steam there, and you would not have to carry the steam backwards and forwards.

1535. (*Mr. Harrison.*) And in some cases the quantity of water would be of importance to the mill below?—I do not know if any of that sewage is of importance to any mill below us.

1536. I do not mean in your case?—I refer to the cases which Mr. Way speaks of—ours is of hardly any value.

1537. (*Professor Way.*) If there was a difficulty in finding space upon any of the premises where the evil is created, would it not be possible to find space elsewhere where there might be a concentration of the liquid?—I daresay that most of us could find space, probably at a little cost to ourselves. I was reading this morning the evidence of Mr. Lynam, the borough surveyor; he says that the river at the outlet of the sewage from the town seems to be clear water, and that the Chorld Beck is infinitely worse owing to the manufacturers fouling that stream. I do not myself think that is the case; I should say that on an average they do not send 100,000 gallons down those waters I went to look at the beck about half an hour before coming here and the water looked quite right. I filled a bottle and have brought it, and this is the character of the water (*producing the same*), but I must say that about 4 or 5 o'clock this evening it will be worse, that is, when the pans are mostly let off.

1538. (*Professor Way.*) That floating matter is dyewood of some sort?—Yes, I have no doubt that it is camwood.

1539. (*Mr. Harrison.*) Would it all be stopped by a filter?—Yes.

1540. (*Chairman.*) Do you think that much of the refuse wool goes away into the water by washing?—A certain portion. Although we have our dye-pans covered over with copper, perforated at the place where the refuse comes out, lots of wool gets through, and every week we have to clean out the drain from the pans through our yard.

1541. That wool, if it were separated from its dirt would be usable for either felting, or spinning, or something or other?—The whole of it would be usable if it did not not go through and get lost.

1542. And if any process could prevent its going through, it would be a gain to you?—Yes, but I do not think that there is a very great quantity.

1543. Did you hear yesterday one of the dredgers say that below Leeds there are deposits of this wool refuse to an enormous extent?—Yes, but in my opinion these deposits come there from the water-closets of the various manufactories. The men will sometimes take the waste wool there, if they have been making too much waste in their spinning and have not minded their work; in order to escape being detected, they throw it down the closet into the river.

The witness withdrew.

Mr. G. Perkin.

Mr. George Perkin (Wakefield) examined.

1544. (*Chairman.*) What business do you carry on?—A cocoa-matting manufactory.

1545. What weight of cocoa-fibre do you use in a year?—About 6 tons a week, as nearly as I can tell.

1546. Where does it come from?—Chiefly from London and from Liverpool.

1547. It comes up to you by rail?—Rail and water.

1548. What does it cost you a ton?—From 22*l.* to 70*l.* per ton.

1549. What part of the world does it come from?—Ceylon, Bombay, and Cochin.

1550. What is the first process which it goes through in its manufacture?—Bleaching; I have brought a sample with me.

1551. What do you use for bleaching it?—Chloride of lime and oil of vitriol.

1552. Where are your works situated?—At the bottom of Kirkgate.

1553. On the margin of the river?—Perhaps; about 150 yards from the river.

1554. Do you pass any refuse matter into the river?—Yes.

1555. Into a sewer first?—Into a sewer first, then it goes into a beck, the Chorld Beck or the Jug's Beck, and finally into the river.

1556. How many people do you employ in your manufactory?—About 100 or 110, men, girls, and boys.

1557. (*Professor Way.*) You deal in cocoa-nut fibre?—Yes.

1558. Does it take much bleach?—It takes a very fair quantity.

1559. You do not bleach it up to whiteness?—I have brought a sample with me (*producing two samples.*)

1560. Can you get it entirely white?—Not at all.

1561. Does the bleaching injure the texture of it much?—No, I think not.

1562. Is the dark colour stronger than the other?—I think not.

1563. Is it kept long in the bleach?—About 6 or 6½ hours.

1564. (*Chairman.*) From a ton of raw fibre do you know what weight of bleached material would come out? How much waste would there be?—There would be none; it is the yarn which we get, we only weave it.

1565. Then the price which you pay is not for the husk of the cocoa-nut, but for this material which you have produced?—Yes.

1566. In your dealing with the materials I hold in my hand you bleach one until it becomes like the other, and the only waste is the lime, chemicals, and the water which you apply to produce the lighter colour?—Yes.

1567. What volume of water and what chemicals would you use to produce a ton of this material?—Perhaps about 1 cwt. of chloride of lime.

1568. And how much oil of vitriol?—About 6 lbs., as nearly as I can tell.

1569. I suppose that the object of bleaching the fibre is partly that you may dye it afterwards?—No, it is partly for the colour of the matting.

1570. But you do dye it, do you not?—Yes, but we do not bleach for dyeing.

1571. What is done with the refuse of the dye-vats?—It is sent down the sewers.

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1572. And then I suppose it goes into the beck?—Yes, and from the beck into the river.

1573. Do you use about 15 to 20 tons of chloride of lime in the year?—Yes, I daresay that I do.

1574. Is there any other chemical process which the fibre undergoes?—No.

1575. You do not boil any of it in alkali?—No.

1576. Is it only the fibre which you deal with in your works?—Only the fibre.

1577. Do you not deal with China grass?—No.

1578. Do you dye this fibre?—Yes, we dye it these two colours, black and red (*producing two samples.*)

1579. What is used in dyeing the red fibre?—Peachwood and a little muriate of tin.

1580. What do you use in dyeing the black fibre?—Logwood and a little green copperas.

1581. What is the red fibre worth a ton?—55*l.* to 60*l.* a ton in the dyed state.

1582. Then this is not of the best quality?—No.

1583. And what is the black fibre worth?—About the same.

1584. Do you manufacture the matting?—Yes.

1585. You have weaving sheds?—Yes.

1586. Is there much refuse, or any refuse at all, from the weaving?—A little.

1587. (*Professor Way.*) Do you keep it?—Yes.

1588. (*Chairman.*) Do you produce other colours besides these?—Only a kind of brown; it is something similar to those.

1589. (*Professor Way.*) I suppose that the contents of your logwood vats, and the vats containing the peachwood that you use, is run into the beck?—The liquid is.

1590. What do you do with the wood?—The woods are taken out and burnt with the slack for the engine. The solid refuse of the chloride of lime we take out and put it into the ash-pit, and it is carted away with the soil; that does not run away.

1591. Have you any way in which you can dispose of the liquid otherwise than by running it into the beck?—We have not at present, but I daresay that it might be done if it was of any benefit.

1592. Does it smell strongly when you send it away?—No; we are supposed to get all that we can out of it.

1593. (*Chairman.*) Are there many fibre makers, or persons who carry on your trade in this part of Yorkshire?—Only, I believe, the Leeds Prison, and the Wakefield Prison, and ourselves.

1594. Then it is not a very large trade?—It is rather a large trade in Wakefield; a great quantity is made in Wakefield.

1595. Where is your principal market for the sale of the manufactured material?—Our trade principally lies with Manchester, or thereabouts.

1596. What is the matting used for?—For covering floors.

1597. For covering office floors?—Yes.

1598. In place of carpet?—Yes; it is a thing of universal wear.

1599. Is much of it exported?—Yes, a great deal of it.

1600. To what part?—To America and Australia.

1601. Then it pays to bring the material here and manufacture it, and to export it to those countries?—It seems so; a great deal is exported.

1602. Do you send any of it back to India?—No, I never heard of its going there.

1603. Is it a new trade with you?—It has been in existence at the prison about 20 years, but with ourselves only about three or four years.

1604. How long have the other manufacturers been in the trade?—There are only ourselves and the two prisons.

1605. I thought that you said that it was extensively carried on here?—It is rather extensively carried on. The prisoners do a great quantity of it; they manufacture something like 15 to 20 tons a week of the matting and mats.

1606. Do they bleach it and dye it as you do?—Yes.

1607. And weave it?—Yes.

1608. Do they put it into the market at such a price that you can compete with them?—Yes.

1609. Is there an understanding between you as to what you should charge?—No, I think that we can compete with the prison labour; we always find free labour as easy to obtain as prison labour, and as cheap.

1610. Suppose that they did not choose to charge for their labour?—They cannot make all that the country requires.

1611. (*Professor Way.*) Do you know anything about the China grass?—No. I know the material, but I do not know the process through which it goes.

1612. (*Chairman.*) Is there any manufacturer of China grass in Wakefield?—Yes; just below the prison; the Yorkshire Fibre Company.

1613. Do the prison people manufacture China grass?—No, I believe not.

1614. Is it a similar process to yours?—I think that it is rather a stronger process to go through.

1615. Does the China grass come in a manufactured form like the cocoa fibre?—No, it comes in raw.

1616. And it has to be bleached and treated entirely?—Yes.

The witness withdrew.

Mr. Daniel Wilson (Wakefield) examined.

Mr. D. Wilson.

1617. (*Chairman.*) What business do you carry on?—I am a soap maker.

1618. Where are your works situated?—At Bridge End in Wakefield, close to the river.

1619. How long have the works been established there?—Four years.

1620. Do you use much water from the river?—We use all that we want.

1621. Do you get any water from the waterworks company?—None at all.

1622. What weight of soap do you make in a year?—I make about 15 tons a week now. I was with Hodgson and Simpson for 25 years.

1623. (*Professor Way.*) In boiling the grease with alkali, what becomes of the water afterwards, when the soap separates?—It is turned into the river.

1624. It is not clear I suppose?—Yes, it is as clear as possible, it is perfectly clear; we do not let any grease go into the river.

1625. You do not take any means to separate glycerine in any way?—No, we have never done so; the glycerine goes along with the spent lees.

1626. You make your own alkali caustic, do you not?—Yes.

1627. What becomes of the lime which is used in that process?—We either sell it or give it away to the farmers.

1628. They fetch it?—Yes, we do not turn it into the river, neither do they turn it into the river at the other works; it is all either sold or given away.

1629. (*Chairman.*) You remember the river, I suppose, for a number of years?—Yes, about 30 years I should think.

1630. Is it better or worse now than it was when you first knew it?—I do not think that there is much difference.

1631. (*Professor Way.*) There is not much difference to you, because you do not care for the quality of the water at all?—No; therefore I could not give an opinion whether it is better or worse.

1632. Is there anything in the drains which would lead you to consider it objectionable?—No.

1633. In making 15 tons of soap in a week, what quantity of water do you use?—I should think that we use something like 15 tons of water.

1634. Only one ton of water to one ton of soap?—That is about it.

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1635. (*Mr. Harrison.*) What proportion of it goes away polluted?—The greater part of it.

1636. (*Chairman.*) Do you use engine power?—Yes.

1637. What weight of coal do you burn in a week?—About ten tons.

1638. What do you do with your ashes?—We do not put them into the river, up to the present time the railway company has taken them away; what we are to do with them by and bye I cannot tell you.

1639. (*Professor Way.*) You say that you were with Mr. Simpson until the last four years?—Yes.

1640. Mr. Simpson I believe makes soda from salt cake, does he not?—He makes his own black ash; he is making the lees from black ash.

1641. Do you do that?— No, I buy my soda ash.

The witness withdrew.

Mr. William Stewart (of Wakefield) examined.

Mr. W. Stewart.

1642. (*Chairman.*) What are you?—Superintendent Registrar of the Wakefield Union, which includes Wakefield.

1643. How long have you occupied that position?—Over 24 years.

1644. What population is there in your registration area?—I think about 55,029.

1645. That includes the town of Wakefield?—Yes, and about 22 other townships.

1646. Is a death and birth registration taken for the whole?—There is a registration for Wakefield township alone; then there is one for the township of Stanley-cum-Wrenthorpe, a portion of which township is within the borough of Wakefield; then there is another township, Alverthorpe-with-Thornes, for which there is a separate registration; a portion of that township is within the borough of Wakefield.

1647. Can you give the mortality for the borough alone?—It would be very difficult to do that. I should have to make separate extracts and it would take a long time to do that.

1648. The registration areas are not always adjusted to the population areas?—No; the mortality of Wakefield would simply be of the township of Wakefield, and the township of Wakefield is less than the borough.

1649. Have there been any cholera epidemics since you have been superintending registrar?—Yes.

1650. In what years?—I think in 1848 and 1849 and 1852.

1651. Do you remember the Irish famine?—Yes.

1652. Had you much typhus fever during 1846, 1847, and 1848?—I do not think that we had.

1653. Do not you remember that the Irish famine caused many Irish to come into Yorkshire, who had the fever upon them?—I do not know whether they had the fever upon them, but the largest number of Irish that we have had has been since the Three Years Residence Act commenced, after 1862; there was a very marked increase then in the population. I have brought with me here a paper which gives the census of 1861, and the census of 1851, then I give you the figures from 1858. I began with that year because I happened to have the figures ready from that time. The paper I hold in my hand will give you from 1858 inclusive, the births and deaths in the township of Wakefield, and I have carried out into the outer margin a calculation of what it would be per 1,000 upon the census of 1861. I have taken the last three years, 1864, 1865, and 1866, taking the three-quarters of the years, and I have added what I believe to be a proper number to make up the population to the present time. I will first tell you how I have got the number of the population at the present time, that you may see whether my calculations are reliable or not. In 1861, when the census was taken, I find by my return that there were 291 empty houses in Wakefield. I assume that there are none now. I am assuming also that there would be at least 200 new ones. I think I am under the mark in saying that, but adding the 200 new ones to the 291 empty houses, I call them in round numbers 500, giving five persons to each dwelling. That would make an addition to the census of 1861 of about 2,500. Taking that estimate, I find that the death rate for 1866 in Wakefield township was about 27·41 per 1,000. In 1865 it was 24·92, and in 1864 it was 25·87.

1654. In this year has there been a large increase in the mortality?—Yes.

1655. Has that increase been more in one part of the year than in another?—This paper will shew that. This year the numbers have been very great. In the March quarter 149; in the June quarter 149; in the September quarter 123; making a total of 421. Then I have taken 130, the average number for the last three years, to make it into a year, and that gives 31·30, according to the old population, and according to the present, 27·41.

1656. (*Mr. Harrison.*) You expect this year to have a mortality of 27·41?—Yes; in place of, in 1862, 20·28; in 1861, 21·64; and in 1860, 22·44, and so on.

1657. (*Chairman.*) What types of disease have manifested themselves this year? Have you had any cholera?—Only one case recently.

1658. What were the types of disease during the early part of the year?—Chiefly bronchitis, and diseases of that kind.

1659. Has there been any typhus?—I have gone through the Wakefield deaths for the last quarter, and I find that there have been only three deaths from typhoid fever. I do not find typhus entered by the medical man. I take the return simply as I find it, but they have had typhoid fever, and there are only three deaths.

1660. Has the state of the weather had any influence during this year?—I always find that in the winter quarter the deaths up to March are heavier chiefly amongst old people.

1661. (*Mr. Harrison.*) Do you know what the death rate is in any of the townships part of which are within the borough?—I have taken also Alverthorpe-with-Thornes, which is partly in the borough, and also Stanley-cum-Wrenthorpe. Owing to our having the West Riding Pauper Lunatic Asylum within the Stanley district, there is not a single return in which the deaths have not exceeded the births. The deaths in this year in the Stanley district have been very heavy; in the March quarter they were 134, and in the June quarter 186.

1662. (*Chairman.*) The asylum, I suppose, has a separate registration, and they will record their own admissions and deaths?—I suppose that must be so; but the deaths are registered in the ordinary way.

1663. Have you paid attention to the condition of the district as to the pollution of the river, and as to the pollution of the atmosphere by smoke, so as to come to any conclusion whether those influences are prejuicial or not to the public health?—I have not. I am not the registrar, I only examine the returns quarterly in order to send up certified copies to the Registrar-General; but I think that the increased mortality in this district has arisen almost entirely from the large influx of the Irish which has taken place by reason of the altered law of settlement. We have a large number indeed, and they live probably in the very worst class of houses, and in the worst localities. We have more Irish in Wakefield than perhaps in any other township of the district. At Ossett, for instance, there are very few Irish residents; the owners will not allow them to live there; but a great deal of Irish labour is used there. I think there are from 200 to 300 Irish girls who go to Ossett daily to pick rags, and those all come back at night to lodge in Wakefield, and return in the morning.

1664. Are you acquainted with the Sanitary Act of last session?—I am.

1665. Are you aware that there are powers given in that Act for magistrates, and guardians, and local boards of health to interfere to prevent over-crowding and nuisances?—Yes.

1666. Looking at the increasing death rate, is it your opinion that the local authorities ought to put in

force those powers?—Undoubtedly they ought, and much more largely than they have done.

1667. (*Mr. Harrison.*) You would not lead us to suppose that the great increase in the mortality has been caused solely by the influx of the Irish who have come into the township of Wakefield since 1862?—No.

1668. Their presence has probably increased the mortality among those with whom they dwell?—Just so.

1669. (*Chairman.*) If the local registrars were paid for it, I suppose they might obtain returns from separate blocks of buildings and from separate localities?—Yes, by having a little tabulated form, showing the different streets. It would not cause much trouble.

WAKEFIELD.

Mr. W. Stewart.

18 Oct. 1866.

The following Tables were handed in:

Township of WAKEFIELD.

Census, 1861 - - - 17,601. Census, 1851 - - - 16,990.

——	Births.	Deaths.	Mortality per 1,000 per Annum.
1858.			
March Quarter - - -	134	98	
June Quarter - - -	138	107	
September Quarter - -	117	87	
December Quarter - -	146	97	
	535	389	=22·1
1859.			
March Quarter - - -	132	87	
June Quarter - - -	137	82	
September Quarter - -	147	117	
December Quarter - -	130	124	
	546	410	=22·3
1860.			
March Quarter - - -	154	134	
June Quarter - - -	155	94	
September Quarter - -	111	68	
December Quarter - -	156	99	
	576	395	=22·44
1861.			
March Quarter - - -	124	114	
June Quarter - - -	147	98	
September Quarter - -	142	75	
December Quarter - -	164	94	
	577	381	=21·64
1862.			
March Quarter - - -	140	110	
June Quarter - - -	163	90	
September Quarter - -	149	64	
December Quarter - -	161	93	
	613	357	=20·28

——	Births.	Deaths.	Mortality per 1,000 per Annum.
1863.			
March Quarter - - -	153	124	
June Quarter - - -	156	95	
September Quarter - -	150	121	
December Quarter - -	160	107	
	619	447	=25·34
1864.			
March Quarter - - -	192	150	
June Quarter - - -	181	122	
September Quarter - -	175	117	
December Quarter - -	155	131	
	703	520	=29·54
1865.			
March Quarter - - -	195	128	
June Quarter - - -	171	119	
September Quarter - -	206	124	
December Quarter - -	172	130	
	744	501	=28·46
1866.			
March Quarter - - -	163	149	
June Quarter - - -	187	149	
September Quarter - -	186	123	
Nine Months - - -	536	421	=23·91
Computed up to December 1866 at - - - -	—	130	
	—	551	=31·30
Computed according to probable present population, which I suppose to be 2,500 - -	—	—	=20·101
1864 - - - - -	703	520	=25·87
1865 - - - - -	744	501	=24·92
1866 - - - - -	—	551	=27·41

STANLEY-CUM-WRENTHORPE.

Census, 1861 - - - 8,237.

1858.		
March Quarter - - -	91	95
June Quarter - - -	60	77
September Quarter - -	68	77
December Quarter - -	70	70
	289	319
1859.		
March Quarter - - -	80	84
June Quarter - - -	89	70
September Quarter - -	66	81
December Quarter - -	66	86
	301	321
1860.		
March Quarter - - -	80	100
June Quarter - - -	62	94
September Quarter - -	71	60
December Quarter - -	84	78
	297	332
1861.		
March Quarter - - -	67	102
June Quarter - - -	91	92
September Quarter - -	78	98
December Quarter - -	66	74
	302	366

1862.		
March Quarter - - -	60	108
June Quarter - - -	92	106
September Quarter - -	53	83
December Quarter - -	97	65
	302	362
1863.		
March Quarter - - -	81	107
June Quarter - - -	93	88
September Quarter - -	69	83
December Quarter - -	77	69
	320	347
1864.		
March Quarter - - -	73	114
June Quarter - - -	91	92
September Quarter -	77	82
December Quarter - -	84	89
	325	377
1865.		
March Quarter - - -	101	121
June Quarter - - -	105	139
September Quarter - -	68	101
December Quarter - -	75	90
	349	451
1866.		
March Quarter - - -	84	134
June Quarter - - -	90	186

WAKEFIELD.

Mr. W. Stewart.

18 Oct. 1866.

ALVERTHORPE-WITH-THORNES.

Census, 1861 - - - - 6,645.

——	Births.	Deaths.	Mortality per 1,000 per Annum.
1858.			
March Quarter - - -	59	30	
June Quarter - - -	50	21	
September Quarter - -	78	36	
December Quarter - -	53	38	
	240	125	=18·81
1859.			
March Quarter - - -	79	39	
June Quarter - - -	64	33	
September Quarter - -	65	33	
December Quarter - -	60	60	
	268	165	=24·83
1860.			
March Quarter - - -	70	64	
June Quarter - - -	80	47	
September Quarter - -	69	31	
December Quarter - -	66	46	
	285	188	=28·29
1861.			
March Quarter - - -	68	64	
June Quarter - - -	66	35	
September Quarter - -	84	24	
December Quarter - -	58	29	
	276	152	=22·87
1862.			
March Quarter - - -	70	49	
June Quarter - - -	80	40	
September Quarter - -	80	27	
December Quarter - -	60	42	
	290	158	=23·77

——	Births.	Deaths.	Mortality per 1,000 per Annum.
1863.			
March Quarter - - -	68	29	
June Quarter - - -	90	26	
September Quarter - -	68	46	
December Quarter - -	88	31	
	314	132	=19·86
1864.			
March Quarter - - -	78	59	
June Quarter - - -	80	39	
September Quarter - -	56	39	
December Quarter - -	85	37	
	299	174	=26·18
1865.			
March Quarter - - -	87	53	
June Quarter - - -	93	43	
September Quarter - -	63	31	
December Quarter - -	57	51	
	300	178	=26·78
1866.			
March Quarter - - -	101	55	
June Quarter - - -	80	53	
Michaelmas Quarter - -	70	32	
December Quarter (say) average of last three years -	—	40	
	—	180	=27·09

The witness withdrew.

Mr. J. Sykes.

Mr. JOSEPH SYKES further examined.

1670. (*Mr. Harrison.*) I think you stated in your evidence yesterday that you first pumped the water into a subsiding reservoir of about five acres in extent?—Yes.

1671. At what periods do you pump the water into that reservoir?—Generally after the flood, just when the flood is subsiding.

1672. You let the first part of the flood carry away any pollution there may be from the bed of the river, and when it is subsiding you fill the reservoir?—Yes.

1673. What number of gallons does that reservoir hold?—Speaking from memory, perhaps 40,000,000 of gallons.

1674. Your supply to the town is 700,000 gallons a day?—Yes.

1675. In that reservoir for how many days have you a supply for the town?—I should say for about two months.

1676. Since your connexion with the water company have you had an opportunity of forming an opinion as to the quantity of matter that subsides in that reservoir?—After the reservoir had been in use for about 27 years, as near as I can calculate, we had an opportunity of cleansing it.

1677. In what year was that?—In 1862.

1678. Did you then empty the reservoir out for the purpose of cleansing it?—Yes, and repitching it, and we took the opportunity of dividing it.

1679. What quantity of sediment did you find in the bottom of the reservoir after that lengthened period?—After the reservoir was run out the mud lay a considerable time before it was removed, and, as far as I can make a calculation, it would be about three inches over the entire area.

1680. Did you make any attempt to carry off any mud with the latter part of the water?—No; the water passed off gently, and left about three inches of mud.

1681. Was that the occasion of which the medical man spoke when the supply was bad?—Yes.

1682. When that reservoir was empty you were obliged to draw immediately from the river Calder?—Yes, I was.

1683. Then was it in the autumn of 1862 when the people of Wakefield had to take bad water or none?—Yes.

1684. Did you take any steps to prevent a recurrence of that state of things in case of cleaning out the reservoir at any future time?—Yes; and we spent a large sum on a division wall, so that we now can cleanse one part of the reservoir ($2\frac{1}{2}$ acres) at any time and work with the other half.

1685. As that is a subsiding reservoir the water has a different degree of purity as you pass from the upper portion to the bottom of the reservoir?—I should imagine so.

1686. Do you take any steps, in drawing the water from that reservoir for your filter beds above, to take the best of it?—Yes, we endeavour to take a foot or 18 inches from the surface by telescope slides.

1687. In drawing from that reservoir you never disturb the bottom of the reservoir or the sediment?—No.

1688. Do the several steps which the water company have taken; viz., the filtering of this large space with a two months water supply for the town taken from the Calder in its best condition, the providing of a large area for subsidence, and the drawing off of only the best portion of the water, tend to improve the supply to the town?—They do.

1689. It would be hardly fair to say that the water

as it comes down the Calder at all times of the year is a fair sample of the water you supply to the town of Wakefield?—Most decidedly not. I may say in addition, now that the waterworks have been established for nearly 30 years, and that with the exception of the period that has been mentioned, the water has not been turned off from the town a single hour from a lack of supply, or any other cause; therefore I think the inhabitants have no cause to grumble on account of a lack of supply. I will now hand in a copy of a report that was drawn up by Mr. William Ranger (*handing in the same.*)

The witness withdrew.

Mr. Rowland Childe (of Wakefield) examined.

Mr. R. Childe.

1690. (*Chairman.*) Are you a civil and mining engineer?—Yes.

1691. Have you kept a record of the rainfall in this district for any length of time?—Only for 12 months; we commenced in September 1865.

1692. What has been the rainfall in that time?—About $25\frac{3}{10}$ inches for those 12 months in Wakefield, from September 1865 to September 1866.

1693. Do you remember what it was for the two months previous to June for each month?—Commencing on September 9th it was ·05 to the end of the month; in October 4·23 inches; in November 1·85 inches; in December ·55; in January 1866, 1·89; in February 2·26; in March 1·40; in April ·95; in May 0·73; in June 2·42; in July 4·4; in August 3·08; up to September 9th, 1·91. I must add, that being sometimes engaged by the water company, during the time of the transition period, when the alterations were going on, and when the water was at its worst, I tried to induce Mr. Statter to consider the possibility of an extension in the immediate neighbourhood. I knew the district in the West Riding of Yorkshire well, and that there was no scheme that could be got for Wakefield without a great expense. The scheme I proposed to Mr. Statter was to take the water from Newmiller Dam, about three miles south of Wakefield, and to convey it to the existing reservoir at Stanley Ferry (which might be done at a very trifling cost), and so utilize the present works, which could then supply the town with that water instead of pumping the water from the river. There is a watershed of upwards of 5000 acres, besides numerous springs in the district occasioned by faults, and likewise there is the surplus water from Cold Hiendley, which has an additional gathering ground of from 600 to 700 acres. There is a reservoir there which is used for the purpose of supplying the Barnsley canal with water in dry seasons chiefly, but there is always a large surplus which comes from that district, and runs into the Newmiller Dam.

1694. Is the Newmiller Dam an artificial construction?—It has been, I have no doubt. I have prepared an Ordnance map to show the plan proposed (*producing the map and explaining it*). I believe the water is rather harder than the river water. This is how I propose to take it down (*describing*), by gravitation.

1695. At the works you would have to pump the same lift that you have to pump now?—Yes, to Field Head.

1696. You would have to deal with any contamination that there is in this area?—Yes, but there is very little, the area belongs chiefly to large landed proprietors.

1697. What would be the estimated cost?—Not more than 10,000*l.*, exclusive of parliamentary expenses and engineering.

1698. What volume of water do you think you would get?—There is a shed of about 5,000 acres, and taking the rainfall available at 10 inches, it would give you a supply of upwards of 3,000,000 gallons a day.

1699. The present supply is 700,000 gallons?—Yes; and taking an available rainfall of 8 inches, it would give 2,500,000 gallons.

1700. What would the storage reservoirs hold?—I do not remember exactly, perhaps it might be necessary to construct additional ones at Stanley Ferry.

1701. Would that come into the estimate you have made?—No; that would be extra.

1702. You cannot say what the cost might be?—I am not prepared to say.

1703. It would be much more than 10,000*l.* I suppose?—Yes.

1704. Have you anything further to add?—I have computed the area, above Kirkgate Bridge, of the watershed of the river Calder, and it is 330 square miles.

1705. Do you know what quality of water comes from that area?—No.

1706. Are you acquainted with the geology of the district?—Yes. We have the coal measures, including the flag stone, up to Sowerby Bridge, beyond that is the millstone grit, and we always get good water from that formation.

1707. The coal measures generally give you hard water?—Yes.

1708. What is the geological character of the area near Wakefield?—It is all in the coal measures; the subsoil is chiefly sandstone, shale, and clay.

1709. In the event of the coal being worked, you would be liable to get the water of the workings?—Perhaps to some extent.

1710. What is the general character of that water?—There is a pumping engine upon the western summit of this water-shed to the Barnsley coal pit, and the water pumped out of that pit is supplied to the cottages upon the works.

1711. Do you know its chemical quality?—No, I do not.

1712. Is not colliery water usually hard?—It is generally so.

1713. Is it not usually hard, with sulphates?—Sulphates of magnesia. In some places there is a great deal of magnesia in colliery water.

The witness withdrew.

The witness subsequently sent to the Commission the following letter:—

Sir, Wakefield, Nov. 2, 1866.

I shall be obliged if the Commission will allow me to make the following addition to my evidence, in further explanation of the water supply to this town.

Since the Commission sat at Wakefield I have minutely computed the extent of the water-shed of the "Cold-Hiendley" reservoir, and find it to be 1,389 acres, instead of from 600 to 700 acres as stated. It is important to have this matter correctly laid before the Commission, not only because the "Cold Hiendley" or "Canal" reservoir (as it is sometimes called) is a powerful auxiliary to the Newmiller Dam catchment, but also in consequence of being one of the schemes recommended by the late Mr. Ranger as the source of an amended water supply for the borough. In the appendix to Mr. Ranger's report will be found Professor Way's analysis of this water, which I subjoin:—

Hardness - - - - $12\frac{1}{10}$ deg.

Solid residue by evaporation of an imperial gallon, 28·72 grains.

Consisting of	Grains.
Water combined with salts and a little organic matter - - - - -	5·60
Silica, alumina, and oxide of iron - -	0·10
Chloride of sodium - - - -	2·36
Sulphate of soda - - - -	6·71
Sulphate of potash - - - -	0·53
Sulphate of magnesia - - - -	4·01
Carbonate of magnesia - - - -	1·98
Carbonate of lime - - - -	7·43
Organic matter - - -	Rather large.

WAKEFIELD.

Mr. R. Childe.

18 Oct. 1866.

Mr. Way also says:—"The water of the canal reservoir "is bright and free from opalescence. Its flavour is fair, "although not quite so free from organic character as that "of the Dakin and Elmhirst streams. It is slightly "more impregnated with magnesia than the last-named "waters, and rather harder. Nevertheless, there is much "in my opinion to recommend the Canal reservoir as the "source of supply for Wakefield."

There is no doubt that Wakefield, from its internal position, is peculiarly placed with respect to procuring a good and pure supply of water. The town is situate geographically in the north-eastern portion of the Yorkshire coal-field (see map which I enclose), and consequently at a much greater distance from the pure water-bearing strata of the "millstone grit" formation than the other large towns in the West Riding; and although now prospering, Wakefield is not such a wealthy and populous place as some of the neighbouring towns, and could not afford, all at once (with the present waterworks on hand) to travel from 15 to 25 miles to other districts, at a cost of from 150,000*l.* to 200,000*l.*, to procure a purer supply.

It is from a knowledge of these facts that Mr. F. Lamb and myself have been anxious the water company should take means to procure the Newmiller Dam scheme as an amended or auxiliary supply. The water is bright and clear, and would require very little filtering, and would effect a considerable saving in the annual expenses of the company, by abolishing the the present pumping from the river, mitigating the labour of cleansing filter beds and other expensive filtering apparatus, now rendered obligatory from the impure state of the river water; but inasmuch as the chief cost of Mr. Spencer's filtering material has been incurred, and the company should consider it no additional expense to continue the present system of filtration, and pass the water through the "magnetic carbide" filters, the result would be that the town would be possessed of a brilliant and abundant supply, and the inhabitants satisfied of having good and wholesome water delivered to them from a different source than the river.

It is certainly wonderful how the water at present supplied to the town is made to look so good. Of course this is caused by the magic agency of Mr. Spencer's patent, but, notwithstanding the appearance, I am informed there is comparatively little of it drunk by the people as a beverage, excepting through compulsion. No doubt this is prejudice, and arises from a knowledge of the source from which the water is obtained.

With respect to the quality of the Newmiller Dam water, I believe it is superior to that of the canal reservoir.

The following is the analysis, viz.:—

	Grains.
Carbonate of soda with a trace of potash	2·50
Sulphate of soda	0·80
Sulphate of lime	5·21
Carbonate of lime and magnesia	6·09
Chloride of sodium	3·20
Silicia and traces of iron	0.16
Organic matter and loss	1·45
Solid residue by evaporation of an imperial gallon	19·41

Hardness by Dr. Clarke's scale - 13 degrees.
„ after boiling - - 6 „

A gauge has been fixed at Woolley 400 feet above the level of the sea (Ordnance datum) during the last 12 months, but the rainfall of the district is not so much as I expected. Perhaps it arises from the gauge being on the slope of a hill which rises in about three-fourths of a mile to the west and south-west nearly 200 feet, which eminence will no doubt intercept the rain when the wind is in that quarter, and especially so when we consider the south-west wind is the most prevalent and more often accompanied with rain than the wind which blows from any other point of the compass.

The register of the gauge is as follows:—

		Inches.
1865	Sept. 9 to 30	0·13
	October	4·19
	November	1·72
	December	0·50
1866	January	0·94
	February	1·65
	March	1·09
	April	0·57
	May	0·67
	June	2·67
	July	3·81
	August	3·17
	September to 9th	1·53
	Total in 12 months	22·64

The area of the water-shed being 5,010 acres, the quantity of water to be obtained would be as under:—

	Gallons.
Due to available rainfall of 12 inches per annum	3,726,000 per diem.
Ditto, 10 inches per annum	3,105,000 „
Ditto, 8 inches per annum	2,484,000 „

There is also a large surplusage flowing down the stream to Newmiller Dam from the canal reservoir, besides numerous springs in the township of Woolley and Notton, yielding immense volumes of very beautiful water.

In addition to the canal reservoir, comprising an area of 105 acres, there are two large sheets of water which now act as subsiding reservoirs, viz., Woolley Dam, containing 16 acres, and Newmiller Dam, of 30 acres, making a total of 150 acres of storing reservoirs all ready provided.

I am, &c.,

(Signed) ROWLAND CHILDE.

G. Lushington, Esq. Secretary to Rivers Commission, Victoria Street, Westminster.

T. Spencer, Esq.

THOMAS SPENCER, Esq. (of London), examined.

1714. (*Chairman.*) You have been engaged for many years in practical chemistry?—Yes, but I have been more especially connected with the chemistry of water since 1846.

1715. Speaking in round numbers, what extent of area in Great Britain, and what number of specimens of water do you think you have examined?—I have examined a great many, including samples from the watersheds for the supply of most large towns. Among the rest for Liverpool, Manchester, Bradford, Leeds, and Birmingham. I am consulting chemist for the Edinburgh Waterworks Company, and I have also examined the water of Glasgow, and Leith and Whitehaven.

1716. Have you examined the Metropolitan waters?—Yes, for the New River Company since 1854, and also for the Chelsea and Lambeth companies. I have also examined the water of this district for the Wakefield Water Company.

1717. Have you made yourself acquainted with the several modes of filtration in use, and with the effect which those modes of filtration have upon water?—I have.

1718. Will you be kind enough briefly to describe the modes of filtration you are acquainted with for waterworks purposes?—First there is the ordinary mode with sand and gravel. Engineers differ somewhat with regard to the thickness of the material in the beds, but from the year 1852 to 1854, when the London water companies were obliged by Government to filter the water, which experiments I was cognisant of, it was found that to get perfect mechanical filtration, about 6 feet 6 inches of material coarse and fine were required; 12 or 15 inches of sand being placed at the top, from which was skimmed periodically some half an inch or an inch, the time varying with the weather. This mode never professed more than to give perfect mechanical filtration, that is to say, the matters in suspension were intercepted at the top layer of sand, and all the other part of the 6 feet 6 inches of stuff beneath merely served to retard the flow downwards, so as to let the water be as still at the top as possible. When the experiment was made with a less thickness of material it was found that the filtration was not so perfect.

1719. That mode of filtration, as you have said, merely separated the mud, or the flocculent particles combined with the water?—It merely separated the particles you mention, in suspension in the water.

1720. Whatever they might be?—Yes.

1721. It did not touch its chemical properties?—No.

1722. Nor its discoloration?—No. It is true, nevertheless, that when the water goes into the filters

a little discolored it comes out less discolored in many instances, but it is found that that loss of color is caused by getting rid of the very small colored particles that escape the eye, for in passing the same water through a thickness or two of filtering paper, all such suspended matters are equally well intercepted, and the difference of color is the same. The change is very trifling, you could not see it in a glass. It is only in a large body of water that any difference of color can be seen. Such difference of color arises merely from the interception of small mechanical colored particles.

1723. Are there modes of filtration which affect water chemically as well as mechanically?—Charcoal of course has been used from time immemorial.

1724. Both wood charcoal and animal charcoal?—Yes, for decoloration. I have also made experiments with charcoal, and find that when put under pressure, and the pores thoroughly stopped up with water, the substance becomes water-logged, so that the action ceases. No doubt there is a decoloring action, as the pores of the charcoal secrete oxygen more than they do carbonic acid or the nitrogen of the atmosphere. Supposing charcoal is put in a moist atmosphere its pores will be filled with air, and when that air is analysed it will be found that it contains a larger proportion of oxygen than the air with which it was placed in contact.

1725. You would say that there was a strong affinity between charcoal and oxygen?—Yes, and so it is with water. We find in round numbers 20 per cent. of oxygen in the ordinary atmosphere, but very often in pure soft water we find as much as 45 per cent. of oxygen, showing that water has an affinity for oxygen. Of course water gets oxygen from the atmosphere with which it is in contact. On the other hand, in the case of less pure water, the amount of oxygen varies from 20 to 35 per cent., but it is very bad water indeed if the air which is contained in it does not amount to more than the quantity that we breathe in the atmosphere. Even impure water contains about 26 or 28 per cent. of oxygen.

1726. Having made yourself acquainted with the filtering qualities of sand, and also with the chemical effects of charcoal, did it occur to you that something additional was required to work a change in water that was chemically contaminated?—It did. I may add, as to charcoal, that in small filters—domestic filters—it lasts a longer time than when under the pressure of water, because in small filters it is used intermittently, and with no particular pressure upon it, whereas when it is placed under pressure for 24 hours, or even a shorter time, it is deprived of its powers; but in small filters charcoal has no power of destroying organic matter. Animal charcoal seems to secrete organic matter within its pores, and after a certain time becomes powerless, and then if it is kept it smells as most persons know who have had filters in use for a long time.

1727. Have you recently seen a recommendation of Professor Frankland to purify all the London water by bone charcoal?—Yes; and I wrote to him to inquire upon what grounds he had made that statement. He said in reply that he had made some magnetic oxide by precipitation, and that he had tested it against animal charcoal; that the water he had used was the water supplied by the West Middlesex Company, and he found that the animal charcoal purified better than the magnetic oxide. My reply is, that I have always stated that precipitated magnetic oxide is not a purifier at all, nor is natural magnetic oxide; and indeed, in a pamphlet which I published on the subject, I said that if even a chemist were living upon a stratification composed of natural magnetic oxide (and the same of precipitated oxide), he would never discover that it was a purifier of water; yet it has no doubt a purifying effect, but so little that it would be set down to mere filtration, and not to any chemical or physical action. He also stated that he had never tried my material, but would do so if I would send him a filter. As, however, they are to be had publicly, he may use his own discretion in regard to the matter. I think it probable that the Commissioners may remember the Mersey and Irwell inquiry with regard to the fouling of these rivers with furnace ashes. I was engaged by the mill owners with Dr. Letheby, and we showed, or endeavoured to show, that the iron contained in the ashes did much to purify the little streams into which the sewage runs. Dr. Frankland and Dr. Hoffman came forward to give evidence that this was not so, and that the iron had no such power. Upon that occasion Dr. Letheby on the bank of one of the small rivers immediately below where a pile of ashes was placed, took a handful of ashes and put it into the filtering paper; he then took some of the logwood water which was passing out from the mill on the bank of the stream, and purified it perfectly; it came out perfectly bright. We then did the same with some sewage water, and all smell and all apparent impurity were got rid of. Our evidence was founded on that occasion on a series of such facts.

1728. Were you led to recommend that the ashes should be put into the river?—We were led to this, that if an Act made it imperative that this iron ash should be kept out of the river, the district would have to be drained and sewered better, or else the sewage which ran into the little streams which are the common sewers of the district, would create a greater evil than the ashes do now.

1729. If both ashes and sewage were kept out of the river I suppose it would be an advantage and the water would be more pure?—No doubt of it.

1730. If you were called upon to provide means to keep those rivers unpolluted, I suppose you would recommend that both those causes of contamination should be kept out?—Yes, I should recommend that every pollution should be kept out of the rivers, but my experience tends to show that rivers are less polluted by sewage than by chemical and other refuse.

1731. What class of chemical works do you refer to?—I mean such as the works of alkali makers, soap makers, gasworks, dyeworks, and a variety of others.

1732. Do you know whether gas can be made without passing any impurities into rivers; and can the whole refuse be utilized?—I believe it can, and so with alkali works.

1733. Probably also in the case of soapworks?—Very probably. I may mention that there are modes of utilizing the whole of the sulphureous and other matters that come from alkali-works.

1734. If it were made imperative by law that manufacturers should adopt measures of prevention, you know that there are means by which pollution can be prevented?—Certainly, in nearly all cases.

1735. With regard to dye works and other works of that class, do you think that any means could be adopted by which the greater part of the pollution could be prevented?—No doubt. I know of no refuse, with the exception of that from starch, that could not be utilized, and even that might be.

1736. (*Professor Way.*) You mean the gluten liquid?—Yes.

1737. I suppose it is easily precipitated?—At the Springfield Starch Works, near Manchester, they have a patent for utilizing starch refuse; it has often come under my notice, because the nuisance is so very great.

1738. Are you of opinion that many of those sources of pollution can be not only avoided, but turned to profit?—I am confident that they can.

1739. Consequently in any measure that may be carried out by-and-bye, there will be no difficulty in finding gentlemen to help the manufacturers out of their difficulties?—I should say so.

1740. Do you think it is a hopeless case?—By no means.

1741. (*Chairman.*) It is a case of pounds, shillings, and pence?—Yes, it is a question of money, and also of will.

1742. As in the case of smoke prevention, it can be done, but as it is not made imperative it is not done by dyers and chemical manufacturers, and all

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other polluters of rivers and streams; but, I suppose, with regard to the utilization of chemical refuse, the field is a wide one?—Yes, it is.

1743. And it has hardly yet been worked?—In very few instances.

1744. Although you may have acquired a considerable amount of knowledge already upon these subjects, I presume that you think there is still a great deal more to learn?—Certainly.

1745. If you had the opportunity, you think you might make discoveries that would be far more beneficial than those you have already made?—I am quite of that opinion.

1746. Necessity is said to be the mother of invention?—It has always been so.

1747. If you create the necessity first, you think that the invention will follow?—No doubt this is generally so. With regard to utilizing the refuse discharged from the chemical manufactories in this country, I think there will be found but little difficulty.

1748. (*Professor Way.*) Including with chemical manufactories, manufactories in which chemicals are used, such as dyeworks?—Yes.

1749. Will you be kind enough to explain to the Commission how and when the idea of using carbide first occurred to you, how you followed it out, and what success attended your efforts up to the present time?—In my investigations as to water supply, I found one complaint in every district that I visited, that was that the springs were becoming everywhere less copious, and that the rivers were becoming more and more polluted. This appeared to be the inevitable result of the progress which the country was making in manufactures, and in the improvement of land. For the foundation of such land improvement, is draining, which implies carrying the rain water as quickly as possible into the nearest river and thence into the sea. It was said, also, and I believe with truth, that the rainfall was becoming less. Altogether, I saw that the question of purifying the water would be worth following out. Accordingly, knowing that spring water was very pure in certain districts, and much less so in others, I resolved to investigate the cause of this difference, believing that it was all alike when it had fallen on the surface, but that it acquired its purity from the nature of the rocks through which it percolated. Comparing Malvern water with water from the red sandstone districts, I found that the water of Malvern was about the purest in England, whilst the water in the red sandstone districts was very much less pure, and that even where it percolated through a larger portion of rock than the Malvern water. For instance, in some cases, at the depth of 500 or 600 feet (to which wells have been sunk), it still retained a considerable portion of organic matter, and that organic matter retained a portion of the contaminating influences of the surface, for example, nitrogenous compounds and phosphates. This led me to the supposition that there was no power of purification in the sandstone, though it contains much iron. After a series of experiments I found that the iron in the Malvern district was in a state of protoxide, or magnetic oxide, whilst that in the red sandstone district was in a state of peroxide. I need not say that filtration experiments after this were easy. My first experiments were made with precipitated magnetic oxide, and I found sufficient to show me that it had a purifying property, but it being in a state of fine powder, the filtration was slow, and the purifying power not such as to induce one to say that it would answer upon a large scale. However, I retained the idea for some years, still with the hope of being able to find some mode of getting magnetic oxide of another character and less cost. Of course I first tried natural magnetic oxide, and I found that that would not do at all. I then got some of the white spathose ore which is a pure proto-carbonate of iron; it abounds largely in Austria, and is found sparingly in this country. After it had been subjected to a slight heat its carbonic acid was driven off, and a comparatively pure black magnetic oxide remained. I then tried an experiment with a glass of diluted port wine. I passed it through a little of the material, and I found it came out perfectly colourless. But that source failed me to a certain extent. The spathose ore was dear, and the oxide from it would soon have become reduced to powder and filtration would have been necessarily slow. The next idea was to de-oxidize the Cumberland hematite. I knew that if I could manage to get rid of an atom of the oxygen belonging to it, it being a per-oxide, the magnetic oxide would remain; but as it was considered the most difficult of all ores to treat, in fact so pure that no iron maker could smelt it except in small quantities with poorer ores, I despaired of treating it. It required such an intense heat as I thought. Ultimately the idea came into my head that perhaps a less heat would do better, especially by putting something along with it which would combine with the atom of oxygen I wanted to get rid of. I mingled with it sawdust, and put it in a retort in my own kitchen fire, and a magnetic material came out which purified water better than anything I had tried before, that is to say, better than any other magnetic oxide. It was, however, brittle, and therefore not suitable for filter beds where it might be required to be washed. The idea had not then come that it should be placed underneath the top sand and there be left alone, but my idea was that it should be mixed with the other material, and of course the matter that it intercepted would require to be washed out. To get over this difficulty by rendering this oxide less brittle, I put an extra quantity of carbon in the hope that it would combine with the oxide as carbon does with steel, and that it would become hard. This took place accordingly, and this is the substance which I have used in the several waterworks which have adopted my plan of purification.

1750. The magnetic oxide which you now use, after all your experience, you consider is one of the best purifiers of water that you are acquainted with?—It certainly is.

1751. Will you state from what substances it purifies the water, you spoke of nitrates?—It does not take out the nitrates, all that it takes out, or rather all that it destroys is organic matter. It takes out the iron, but the iron is not destroyed; the iron is left in the filter; for example, in Southport, where the process has been in use now for seven years. The works there were made and pipes laid down before the well was sunk, but the waters turned out to be chalybeate water. Of course the company went on pumping, thinking the evil was merely temporary. However, after pumping for several months, the iron still continued to come and no one would take the water. I was then asked whether I thought carbide would take out the iron, and I said that I thought it would, though the great object of it was to take out organic matters. Samples of the water were sent to me, and it was found that the carbide took out the iron effectually. We put carbide into the filter beds, and they have been at work now for nearly seven years, and the Southport people boast of having as pleasant water to drink as any town in Lancashire. We made the filter beds so that they could be flushed upwards to take out the iron which had been attracted out by the magnetic oxide. Once in two or three weeks, sometimes once a month, those filter beds are flushed from below, and the iron water comes up like so much peasoup, and goes out into a gutter, and then the material works as vigorously as it did at first. The engineer who has the superintendence of the works says that it works far better than it did at first, that it has been improved. Salts of lime and other things in the pores got washed out.

1752. From what formation does the water of Southport come?—It comes from the new red sandstone, and not far from an extensive peaty bog.

1753. Does the chalybeate come from the bog?—Probably, though there are in this district pots of ironstone in places in the sandstone.

1754. Has the chalybeate anything to do with the

coal measures?—I should not say so, because there are no coal pits very near.

1755. You are aware that there is some singularly pure water in that same sandstone, the Ormskirk water, for instance?—Yes, that is exceedingly pure.

1756. And the Wallasey water?—They are both about the same.

1757. Not exceeding five degrees in hardness?—The Ormskirk water I have found it to be at five degrees and at seven.

1758. Of what quality is the Green Lane water?—When I first analysed it, it was five degrees. It is now nearer 12 or 13.

1759. Has it been increased by over pumping?—Yes; I may mention that at Southport there is a large proportion of organic matter in the water as well, and the carbide deprives it of the organic matter and the iron at one and the same time.

1760. What are the organic substances or bodies that are most injurious, and which the carbide deals with most effectually?—That which chemists usually call organic matters arise from the soakings of decayed vegetation. When we find nitrates or phosphates we set down their origin to animal matters. Not that nitrates or phosphates are injurious in themselves; on the contrary, a little nitrate of potash in water is a very good thing. They are objectionable chiefly because their presence only denotes their origin in animal impurity.

1761. Does the carbide deal in the slightest degree with common salt?—No.

1762. Is there not a large amount of common salt in the Southport water?—Not so much as there is in some of the Liverpool wells, but from five to six grains, and that seems constant. I thought at first when I found it that it might come from some fissures where sea water comes in, but seeing that it is so constant, I now think it belongs to the stratification.

1763. The new red sandstone is a great salt-bearing stratification, is it not?—No doubt it is. Perhaps you will permit me to explain the action of the carbide upon organic matter. This magnetic substance attracts and secretes oxygen in its pores, and all water, as I at first stated, has a considerable proportion of oxygen. When this oxygen, after its attraction by the carbide, comes into contact with the organic matter it becomes changed into carbonic acid. I have already stated in print my firm belief that the magnetic oxide has the power of ozonizing oxygen, and it is all but universally believed now that ozone is merely a double atom of oxygen. Now, as carbonic acid is made up of one atom of carbon and a double atom of oxygen, and seeing that the result of the purification of the water which passes through carbide is an increase of carbonic acid, I arrive at the conclusion that the carbide changes the organic matter into carbonic acid. A very nearly similar operation goes on in our lungs; the oxygen which comes in seizes the carbon with which the blood is charged, and immediately becomes carbonic acid. We have the same process going on in the water which passes through the carbide, inasmuch as we find less carbonaceous matter after filtration, and more carbonic acid than we found previously. Brown coloured peat water for example (which possesses a large amount of organic matter), when passed through a considerable thickness of the carbide, comes out sparkling, as if carbonic acid had been forced into it as in soda-water making.

1764. I assume that before attempting to treat this Wakefield water you analysed the water in the state in which you found it?—Yes.

1765. And then you advised the company as to whether the carbide would be beneficial or otherwise?—I reported to the company in its favour only after making several analyses, and examining all the district around to see where an unobjectionable supply of water could be had. I then advised them to adopt the present method of purification; but I confess that I did not give them hopes that the water would be as pure as spring water, and I think that I should have hesitated even more than I did had I heard the evidence which I have heard to-day with regard to the amount of impurity which gets into this river. I was not aware at the time that the foulness was so great. Still I told the company that its thorough purification was a question of quantity, and that nine inches of carbide would render their water as good a water for the supply of a town as most towns had. I stated that the organic matter would not be all taken out unless there was a layer of some 12 or 15 inches; but still that nine inches of carbide would render the water a very good town supply, and I cannot help saying that so far that result has been obtained; but while I say this I must also state that there is more water passing through the present filter beds than I intended should pass through.

1766. You are aware that they are enlarging them?—Yes. When you take into consideration the time for cleansing, I should say that there is more water by nearly one half passing through than I had contemplated.

1767. (*Professor Way.*) That is because time is an element?—Yes.

1768. (*Chairman.*) What number of gallons would you like to pass through a square yard of the surface in 24 hours?—If you gave me an unlimited thickness of carbide I should be able to purify 1,000 gallons through every square yard in 24 hours; but with limited quantity, such as we have in Wakefield, I should say that not more than 500 gallons ought to pass through each square yard.

1769. (*Professor Way.*) Do you mean each superficial yard?—Yes.

1770. But it must have some thickness?—Yes; give me a layer of carbide of any thickness, and the water will come out without any organic matter.

1771–2. When you say a superficial yard, what thickness do you mean?—That is regulated by the impurity of the water. In the Wakefield beds we have, I think, nine inches, with some sand along with it.

(*Mr. Sykes.*) That makes it 15; we were at first about to adopt six, but at Mr. Spencer's suggestion we adopted nine.

(*Mr. Spencer.*) I remember that, on one occasion, I found the water in a worse state than I had ever seen it before.

1773. (*Professor Way.*) It resolves itself into the length of time that each individual atom of water is in contact with the material?—That no doubt is so.

1774. Therefore, if the liquid passes through it at a rapid pace the action is not complete?—That is so.

1775. But, so far as it goes, will the purification have any relation to the time?—No doubt.

1776. More of the organic matter will be burnt out in a longer time?—Yes.

1777. (*Chairman.*) I suppose that the action follows a great chemical law, that combustion, as it is termed, is a combination of new elements, and that time must come into play?—Time, I need not say, is an element in every natural operation, and carbide filtration is no exception.

1778. In the explosion of gunpowder there is no such thing as perfect combustion, because the time does not admit of it?—Just so.

1779. If you set up a furnace to consume foul gases, however intense you make the heat of that furnace, some of the gases will escape unconsumed?—That is so, and it illustrates the slower combustion, if I may so speak, that takes place in the water.

1780. To produce perfect combustion you want a new substance, but you also want the element of time?—Yes.

1781. So as to allow the particles to act and re-act upon each other, and to change their character?—Yes.

1782. Combustion, as the word is used and is understood vulgarly, has no meaning, if it means destruction?—Just so, without the visible production of another element.

1783. It is a change, in fact?—Yes.

1784. What we mean by combustion is changing one element into another?—That is so, or one substance into another.

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1785. Altering its character?—Altering its character.

1786. A substance is injurious in one form, but you alter its character by what is termed combustion, and it becomes non-injurious?—Just so.

1787. And that is the effect which you desire to produce by carbide filtration?—Precisely.

1788. Is it not commonly said that it is impossible to make water which is once impure bright by anything but mechanical filtration?—Yes, that is said generally.

1789. And that there is no such thing as chemical filtration?—That is so.

1790. But you say that there is chemical filtration?—I call it physical filtration.

1791. (*Mr. Harrison.*) You are aware that the water at Wakefield has a considerable quantity of iron in it?—Yes.

1792. Have you tried whether the iron is removed from the Wakefield water by this process?—Yes; there is very little left—there is nothing which interferes with the water for a town supply; there is no more iron in it and rather less than in the ordinary chalk water of the London district.

1793. And a considerable quantity is removed from the water?—Yes; but I believe that much of the iron which used to be in the Wakefield water, when a part of it came through the gravel wells, was precipitated in the subsiding reservoir—for we made experiments on the water as it came in and as it was pumped out, and we found that there was less iron in that which came out from the reservoir.

1794. Have you analyses which show the difference of the water as it passed into your filters and out of them?—Yes; but iron has not been an element thought of since the use of the carbide. The Wakefield Company never delivered, to my knowledge, even previously to my filtration, water with an objectionable portion of iron in it; had it been so we should have made special experiments upon the point, but as the water was never objectionable on that account after it got up to the filter beds, we took little account of it. But in making analyses of the water since, the small proportion of iron which was left was of course noted.

1795. Is organic matter which we find in water derived from either vegetable or animal refuse?—Yes.

1796. What is the striking difference between the two?—For example, if you soak vegetable matter and animal matter you will find on analysis that they both contain carbonaceous matter largely, but that the animal soakings contain nitrates and phosphates, or rather their elements, for it is a long time before nitric acid is formed, and a long time before phosphoric acid is formed.

1797. Then, if I understand you rightly, the presence of nitrogen is indicatory of animal matter?—Yes.

1798. As to nitrogen contained in organic matter in water, how is it affected by the carbide?—Not in any way.

1799. How are nitrogenous matters affected?—Nitrogenous matters are spoken of very loosely in chemical analyses, they are generally indicated; in the report nitrates, and those may be nitrates of lime or nitrates of magnesia, or nitrates of soda, but they are generally very small. They must first be formed into nitric acid before they become nitrates, but they are then perfectly harmless, and they are only spoken of as indicating that the water has passed over or through animal matter.

1800. And if you could show us that the nitrogen in the organic matter was in the form of nitric acid or nitrates, there would be an end of the question, but if there is nitrogenous matter in the water not in the form of nitric acid, or nitrates of any kind, is it at all affected by the carbide?—The carbide would destroy the carbonaceous portion belonging to what you would call nitrogenous matter, and in so doing destroy its putrescent power. But it is hardly the proper term—that however is the usual mode of putting it.

1801. (*Professor Way.*) Carbonaceous matters, you say, are laid hold of by the carbide, and are converted into carbonic acid?—That is organic matter—usually a large proportion of which might be called humic acid in solution.

1802. Does the carbide deal with and get rid of, so far as the objection is concerned, matter which is not only carbonaceous, but which contains as one of its elements nitrogen. For instance, supposing that the water contained animal matter in the nature of gluten, would your oxydizing medium oxydize and destroy it?—It has the effect of promoting its change into ammonia.

1803. Then it is oxydized and destroyed?—Yes, and afterwards it becomes nitric acid.

1804. But it destroys it so far us being injurious?—No doubt it does.

1805. Whether the material in the water be nitrogenous or carbonaceous, or both, the carbide lays hold of it and changes its nature, and converts it into different bodies which are not injurious?—Yes. In order to illustrate that I may state that I have taken pieces of raw beef and have mixed it up with the carbide, and have kept it moist for two or three weeks. No smell ever arose; but on examining the beef I found that it had rotted, that is to say, that you could bruise it when dry like so much rotten wood.

1806. (*Mr. Harrison.*) If, as you stated to Professor Way just now, the carbide had had the effect of converting the nitrogen into ammonia, would not the ammonia have escaped and have caused a smell of some kind or another?—I did not make this experiment with regard to water, but simply to see the effect of the carbide upon animal matter. The truth is that I thought that the carbide might be made a preservative.

1807. (*Professor Way.*) And you found it just the contrary?—Yes; so much is its tendency to rot or destroy organic substances that the bags in which we carry the carbide form a serious item, for the carbide rots holes in them, especially if the bag is kept in rain, or if the railway truck is not covered.

1808. It changes it, in point of fact?—It does, and destroys it.

1809. Is it not the fact that matters which in their slow combustion, that is to say, in fermentation or putrefaction, would produce smells, may be carried through those stages so that the smells never become apparent?—Yes.

1810. So that, instead of causing the stages of gradual destruction in which gases which stink are produced and are injurious, you may carry a substance right through those stages at once to the ultimate condition so that it never smells at all?—Yes, by the carbide, far more quickly than by any other process which I know.

1811. That, I presume, is to be done by other processes than the carbide?—Yes.

1812. Spongy platinum does it?—Yes.

1813. And animal charcoal does it?—Yes, to some extent.

1814. Is it not the fact that mechanical filtration does, to a certain extent, purify water chemically. Would you not tell Mr. Simpson, of the Chelsea Waterworks, that his filtration does to a certain extent purify water from organic matter in solution?—It is true there is somewhat less of organic matter in the water of the London companies after filtration than before, but this is due not only to the mechanical effect of filtration, but to the sand which they use having a portion of iron in it. Thus we found that pure white silver sand had no effect upon the purification of water beyond the ordinary mechanical one, but whenever the sand contained oxide of iron we found an effect. The same took place with regard to the sand in the Liverpool filter beds. After I had arrived at a knowledge of the carbide, and knowing that some small purifying effect was produced by filtration on the Liverpool water, I took a magnet and ran it through the sand, and it came up covered with particles of iron oxyde. On inquiring where the sand came from, which was said to be the best filtering

sand which they had had among a great many sands, we found that it came from the mouth of the river at Preston, and that the river received all the ashes of furnaces. These, in fact, were porous pieces of carbide, which no doubt had come from the cinders, and they were analogous to the carbide which I now make.

1815. When you say carbide of iron, do you believe that it is a carbide of iron, or is that a convenient name?—It is a convenient commercial name.

1816. Because it is made in that way?—Carbon is necessary to be in it in order to make it hard, but it does not take it in always in atomic proportions.

1817. It is not its chemical name?—No.

1818. It is a magnetic oxyde of iron?—Yes; and yet a magnetic oxyde of iron, as such, does not answer. Chemically speaking, it is a magnetic oxyde of iron containing carbon.

1819. With regard to its action, is the secretion of oxygen which you speak of, from the air, a secretion of oxygen bodily in the pores as a mechanical action, or is it a combination of oxygen to form a higher oxyde of iron?—My view is that the oxygen is secreted physically. The magnetic oxide has an affinity for oxygen but not the power to take it up.

1820. Without saying why this magnetic oxyde (so-called carbide) attracts oxygen into its pores, you simply say that it seems to have the power of secreting oxygen in a physical condition?—That is my conclusion.

1821. Not that it becomes a peroxyde of iron, for instance?—Not at all.

1822. The next stage is this—organic matters of different kinds, both non-nitrogenous and nitrogenous, come in solution in the water to the pores and to the surfaces of this carbide, and are received as oxygen?—Yes.

1823. And they become altered and burnt into different compounds?—Yes.

1824. Do you suppose that these organic matters reduce any of that magnetic oxyde to a lower degree of oxydation?—I suppose not.

1825. It still remains untouched?—Yes. In Southport, where the process has been used for the longest time, they have not applied to me for any additional carbide, but as they are now going to give a larger supply of water, I may have an order for more.

1826. At all events we may take the fact that you do not believe that it undergoes any chemical change either when it receives the oxygen, which it subsequently loses, or when it loses that oxygen?—My belief amounts to a certainty in these respects.

1827. That being so, the thing to be done so soon as that oxygen is exhausted is to replace it, is it not?—Yes.

1828. Is it replaced to any great extent by the water carrying oxygen with it?—No doubt it is, because when distilled water has been put into a steam vacuum containing no oxygen, and organic matter has been put into the water, and the water has been passed through the carbide in closed-up vessels, the organic matter has remained.

1829. That is an experiment which you have made?—Yes.

1830. Do you think that in the case of rivers, for instance, you can trust that there is oxygen enough in the water for oxydation of organic matter which is in the water?—Usually so—though in times of drought, when the water is very bad, I have recommended Mr. Sykes to allow the filters once a day to lie fallow, if it is even for half an hour.

1831. For the purpose of getting the air through them?—Yes, in order to get a fresh supply of oxygen to recruit them.

1832. I suppose that if those facts were once ascertained, and if the value of your material was recognised, there might be improvements in the form of the filter?—No doubt.

1833. So that there might be better aëration?—Yes. I have introduced a mode of filtration, which is used at Wakefield and at several other places. It is to be introduced at the Calcutta Waterworks, which are now being made. There we can have only 3 feet of material, and if there is not room for 3 feet we could even do with less, and the same mechanical filtering results would be obtained. It would require a drawing to explain the mode of filtration, but it combines the descending and ascending mode and very simply. It has made a saving in the estimates of the Calcutta Waterworks of 42,000*l.* for the filter beds alone, the beds thus requiring less wall, and less thickness of sand and gravel and lest lift of water.

1834. That is a difference of 42,000*l.* for the mere shape of construction?—Yes, because much less head of water is required. I always recommend as thin a head of water as possible. The first part of the works is to give 8,000,000 gallons. I was driven to this mode of filtration by necessity; the fact of the black and heavy particles of the carbide being carried down along with the water drove me to endeavour to invent a mode of obviating it.

1834*a*. Last evening we went with Mr. Sykes to the waterworks. We examined some of the water as it came into your filter beds and as it left them, and undoubtedly there was a very considerable difference in the colour of the two. Is it likely that the remark which you made with reference to the Chelsea water and other waters, which being filtered through paper, had lost their colour, owing to the extremely minute portions of coloured matter, merely matter in mechanical suspension, having been removed from them, applies to the sample which I saw last evening?—I do not think so, because the London companies' water goes in from the river without subsidence, but here it subsides, which with water so mechanically impure, is half the battle.

1835. Have you tried your material on such liquids as coffee and wine?—On wine.

1836. Does it take out the colour of wine?—If the layer is sufficiently thick it takes out the colour entirely.

1837. Will it remove the colour of a solution of coffee, for instance?—I have not tried it on coffee.

The witness withdrew.

Mr. Robert Dent (Wakefield) examined.

Mr. R. Dent.

1838. (*Chairman.*) What are you?—A dyer.

1839. Where are your dyeworks situated?—At Belle Isle.

1840. What number of persons do you employ upon your works?—About 100 when we are at full work; about 70 now, perhaps.

1841. Are your works situated upon the banks of the river?—Yes.

1842. How long have your works been situated there?—We have tenanted them about three years. The greater portion of the place is perhaps from 80 to 100 years old; it has been enlarged at different times.

1843. How long do you remember this river?—I have known it ever since I was a child.

1844. Is it worse or better now than it was when you knew it first?—It is worse.

1845. How long have you been a dyer?—I have been a dyer for Mr. Holdsworth about 17 years. I have worked there 40 years, on and off. Mr. Holdsworth is the landlord, and we are the tenants. The works have been divided. Mr. Holdsworth continues a portion of them, and we have the other portion. He has the cloth department, and we have the stuff.

1846. Do you use the water for dyeing and washing?—Yes.

1847. And have you used it all that time for dyeing and washing?—Yes.

1848. Can you dye and wash the same colours now

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as you could when you first began?—I cannot say that; the water is not so good for some colours.

1849. For what colours is it not so good?—Scarlets, crimsons, and yellows, and those delicate colours.

1850. Have you given over dyeing any of these colours on account of the badness of the water?—No, we dye all colours that we did; we take all that come, we do not send any away.

1851. Do you think that as many of those choice colours—for instance, scarlets—come to you as formerly?—I believe that there are some that we cannot dye so well as we could 30 years since, for instance, scarlets or anything of that sort; the colour is changed by the alkali. If the water is polluted by alkali the alkali will neutralize the acid, and turn it blue, and so rather injures the work.

1852. What kind of alkali do you think the water contains, alkali from soap works?—Yes, a great deal from soap works.

1853. Do you use any of the waterworks water for washing or dyeing?—No.

1854. Have you any well upon your premises?—We have a large reservoir. We always keep a full supply against a fresh, against an accident to the engine, or any breakdown.

1855. You have a large reservoir in which you let the river water subside?—Yes.

1856. And you do not use the water directly as it flows or is pumped from the river?—Only for washing, and for some colours which it will not injure.

1857. Do you use engine power?—Yes.

1858. What do you do with your ashes?—We put them all into a boat and take them away.

1859. On the river?—No, we make a great heap, and we let anyone have them for carting them away.

1860. You do not put them into the river?—No.

1861. Do you think that the condition of the river now is such as is desirable, or that it ought to be improved?—It is not so good as it was 20 years since. We can dye with the river water a great deal better at sometimes than at others. After a long drought the water is very low, and then it is worse than at other times; but when the water is at a pretty fair height I do not know that we have any particular reason to complain.

1862. If it has grown worse within the last ten years, do you think that if it is left alone it will grow worse in the next ten years?—I believe that it will if there are not some means used to prevent it.

1863. In your opinion, should it be prevented or would you leave matters to go on as they have gone on?—I think that if means could be found to prevent it it would be a very good thing for both the dyers and the manufacturers of the town.

1864. I suppose that you, too, pollute the river?—Yes, all that we have to spare we put into it.

1865. Spent material from the dye vats?—Yes, a great portion of that, not all.

1866. Do you use much indigo?—No, Mr. Holdsworth uses indigo largely.

1867. What do you do with the spent material, and the refuse which you produce?—Some portion of it goes into the river, and some we get out; we boil it in bags, where it does not injure we put it into vessels.

1868. I suppose that there would not be any very great hardship in manufacturers being compelled to keep out all the spent wood, madders, and logwoods, and so on?—I do not know that it might not be overcome.

1869. But I suppose that you do not feel inclined to overcome it if left alone?—I do not feel inclined to be at the expense of overcoming it myself. Mr. Holdsworth is the landlord, and I think that he is the person who should do it. I could not stop my business for it; I have not made my fortune yet.

1870. (*Mr. Harrison.*) Are you aware that in the upper part of the river, above Huddersfield and other places, manufacturers tip a considerable quantity of ashes into the river?—No, I am not.

1871. Can you tell me how it is that you manufacturers lower down on the Calder do not follow their example?—We dare not do so for an hour long, we are always watched.

1872. By whom are you watched?—By the Aire and Calder Company; Mr. Richardson is the person.

1873. Then the Aire and Calder Company have the power of preventing you putting ashes into the river?—Yes; I have known a case of a man accidentally letting a barrowfull go into the beck, and tumbling in with them himself; he has been reported.

1874. We had evidence this morning from the man who dredges the river, that he not only dredges up ashes but a quantity of spent logwood and other materials from the dyeworks. Does not the navigation company prevent you from putting your refuse into the river?—No, nothing but ashes.

1875. The other refuse slips more quietly in than ashes would?—Yes.

1876. If the Aire and Calder Company knew of it would they say anything to you about it?—I am not aware, but I think that they do know.

1877. (*Chairman.*) I suppose that if you had not this inspection, the probability is that some of your ashes would accidentally tumble in?—I do not know that; we have servants to take them away, and Mr. Holdsworth has put his ashes on to his land, and levelled his land.

1878. With ashes?—Yes. Adjoining to Mr. Wedd's mill there is about an acre of land where we have thrown all our ashes, excepting the time when the railway company took them.

1879. (*Mr. Harrison.*) How do you take the ashes to that heap?—We wheel them by barrows into the boat.

1880. And then you have to get them again out of the boat?—Into carts if anybody wants them.

1881. At what expense are you per ton in removing those ashes to that spot?—It will perhaps take three men a couple of days loading and delivering a cargo at 3*s.* a day.

1882. (*Professor Way.*) How much is a cargo?—About 20 tons, from 16 to 20 tons. I do not know exactly.

1883. (*Mr. Harrison.*) That is an expense to which you are put in the lower part of the river which the dyers and others in the upper parts where they tip into the beck are not put to?—Yes.

1884. (*Professor Way.*) What dyes do you mostly use?—We use more logwood than anything else; I think Honduras generally speaking.

1885. I suppose that in smaller quantities you use very many different kinds of woods?—Yes, we use peach wood and fustic logwood.

1886. But logwood is the principal quantity?—Yes.

1887. In emptying the different dye-vats into the water, which are the most coloured liquids?—The liquid from logwood, is black; from peach wood it is red. That is the deepest colouring matter running into the water; the liquid will be red like blood and will foam up; still it might not really be much stronger than logwood is. We consider that all the strength has gone out before the liquid goes into the river.

1888. You use it as far as you can?—Yes.

1889. But still it has a considerable colour when it goes in?—Yes.

1890. Does it colour the stream at the time that it is going in?—Yes.

1891. How often are the vats emptied, once or twice a day?—Some are emptied once a day, and some, perhaps, may be emptied two or three times a day; it depends upon the quantity of work, and the facilities with which they have to work.

1892. But no day, except Sunday, ever passes without a vat being emptied?—No.

1893. What are the sizes of the vats, what do they hold?—We call them cisterns; they vary from 100 gallons to 500 or 600 gallons.

1894. If we were to say that 1,000 gallons are

emptied every day, should we be above or below the mark?—There are above 1,000 gallons.

1895. Out of the vats?—Yes.

1896. That is apart from washing?—Yes.

1897. There is the wash water besides?—Yes.

1898. Which is more or less coloured?—That is not much coloured.

1899. Is the liquid from peach wood transparent, can you see through it?—Yes.

1900. It would not settle?—No, except there were any dregs in it.

1901. It would not become clear like water by standing?—No.

1902. And with logwood the case is the same?—Yes.

1903. The stuff is in solution?—Yes.

1904. You have not made any vats or anything to try and separate the solid?—No.

1905. Does your landlord do anything of that kind?—No; we have thought of seeing Messrs. Teall to collect our soap.

1906. You do not even do that?—No; we do not know whether it would be worth while for Messrs. Teall to do it, as we do not use soap to so large an extent as some persons do.

1907. Have you space on your premises for making vats or subsiding reservoirs on a moderate scale if you wished to do so?—I cannot tell what sort of a place would be wanted exactly.

1908. Have you a yard?—Yes.

1909. (*Chairman.*) As big as this room?—Yes, as big as this house altogether.

1910. (*Professor Way.*) Is it generally the case that dyers are cramped for room, or have they usually plenty of room?—Latterly they have begun to build differently, or else, generally speaking, they used to be cramped, but I believe that now they are not so.

1911. As a rule they have some room to spare?—Yes, generally.

1912. Is it so generally in this district?—Ours is the only place in the district where stuffs are dyed.

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1913. But many woollen manufacturers dye for themselves?—I do not know that. Manufacturing is not my business.

1914. (*Chairman.*) You dye stuffs?—Yes.

1915. Bradford stuffs?—Yes.

1916. Bradford cloths?—We do not dye much cloth.

1917. (*Professor Way.*) Do you think that you waste anything of value?—I daresay that we do sometimes; we are obliged to do so, but I can assure you that we do not when we can help it.

1918. Are you speaking of turning in a dye vat before the dye is exhausted?—Yes.

1919. But, speaking generally, supposing that a vat has been worked up to its utmost, is there anything in it of value that could be reclaimed?—I think not, excepting soap.

1920. Do you use any large quantity of tin?—We use it but to no great extent.

1921. What you do use goes away with the stuff?—We consider that the goods take a certain portion of the tin, or we should not put it in. Tin has an affinity for the dye wares.

1922. (*Chairman.*) Is there anything further which you wish to add to your evidence?—I do not know that there is, except that Mr. Holdsworth is not at home, and he wished me to invite you, gentlemen, to come down and inspect the works, if you had time, before you went away.

1923. I suppose that the evidence which you have given with regard to your own works would apply to Mr. Holdsworth's works?—Yes.

1924. (*Mr. Harrison.*) His works are indigo works?—Yes, but his slack refuse goes down the same drain as ours.

1925. (*Chairman.*) Are his works larger than yours?—No, ours is the largest portion.

The witness withdrew.

Mr. Matthew B. Hick (Wakefield) examined.

Mr. M. B. Hick.

1926. (*Chairman.*) In what business are you?—I am a copperas manufacturer.

1927. Where are your works situated?—On Westgate Common, by the side of the Ings Beck on the river Charld.

1928. (*Professor Way.*) By copperas you mean sulphate of iron?—Yes.

1929. You make it for logwood dyers principally?—Yes, and for making nitrate of iron liquid.

1930. Which is used as a mordant?—Yes.

1931. Do you make it from metallic iron?—From iron pyrites.

1932. By roasting?—No, by percolation. The rain percolates through the bed of pyrites into cellars.

1933. Is the liquid pumped up again?—Yes, and then we apply more iron to produce peroxide of iron.

1934. Does it take a long time?—It takes about a fortnight to get the proper strength for crystalizing. It is as neutral a salt as we can get.

1935. Does the pyrites heat?—No.

1936. Is it heated artificially?—No.

1937. Is that iron pyrites or copper pyrites?—Iron pyrites.

1938. With no copper in it?—I believe not.

1939. Have you used the Spanish?—No; I have seen it, but have not used it.

1940. You do not know whether that would be suitable to you?—It would be much more expensive.

1941. But you would sell the copper as a rebate afterwards?—I have only seen it, but have not tried any of it.

1942. You evaporate it in pans, and crystalize it?—Yes.

1943. The vats into which this matter runs, I suppose, are tight; you do not lose any of the liquid?—Just so. They are all lead coolers, and there is a plug. None is wasted. We boil the liquid over again.

1944. Does all the iron pyrites disappear by degrees?—I suppose that the pyrites does, but of course there is a great deal of coal dust and refuse which we have to cart away afterwards.

1945. What do you do with that?—We send it to the brick ponds, or anything of that sort.

1946. Of what size are the heaps?—It is one large bed. I should think that it is half an acre.

1947. How long would it take to oxydize a ton, for instance, or 20 tons?—I do not know, but it will take years. It is four or five years before it begins.

1948. Then you have one bed in preparation, and one bed at work?—It is all one bed. We begin at one end of it, and keep leading on the new pyrites at certain places, and take the old away to the far end. We replenish it. It takes four or five years before we begin to do much with it.

1949. You simply expose it to the rain?—Yes, and if there is no rain we water it.

1950. (*Mr. Harrison.*) What is the thickness?—Five or six feet in some places.

1951. (*Chairman.*) Where does the pyrites come from?—From coal pits in the neighbourhood.

1952. Is it in the roof or in the floor of the coal?—It is mostly found in about the middle of the seam of coal.

1953. It is what would be called bass, I suppose; if it went away with the coal it would burn into a white ash?—No, it would not burn; it would crack and fly about.

1954. Then it is that portion which causes explosions when it gets into the fire?—Yes.

1955. (*Professor Way.*) I suppose you riddle it out of the small coal?—Yes.

1956. Do you get any alum salt?—No; there are alum works in the neighbourhood, and they would get all that.

1957. Do they supply you?—No.

1958. (*Mr. Harrison.*) What is the price of the

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sulphate of iron which you manufacture?—From 3*l.* to 4*l.* a ton.

1959. Are you aware that in South Wales, in the manufacture of tin plate, from some of the works they throw away large quantities of the liquor, which you are at great trouble in collecting?—I know that that has been the case. They are using it now I think.

1960. In some of the works, but by no means universally. In some very large works which we visited a short time ago they will not take the trouble to extract the sulphate of iron, but they allow a part to pass into the brook, which you here take as a material for regular manufacture?—I was not aware of that.

1961. (*Professor Way.*) Is the consumption very large in this neighbourhood?—Not very large. The trade is principally in our hands.

1962. One of the witnesses told us just now that he was not using iron, either for indigo or for logwood?—No, they use more now of bi-chromate of potash.

1963. It is more expensive, but a small quantity of it goes a long way?—Yes. When these copperas works began the copperas sold at 15*l.* a ton.

1964. (*Chairman.*) Do you pollute the river at all?—Not at all.

1965. How long have you known the river?—For 20 years.

1966. Is it more polluted now than it was when you first knew it?—Very much.

1967. Do you think that it is necessary to do something to stop that pollution?—I do indeed. About a year ago there was very little rain, and one night I observed that the river below the bridge was in a frightful state. It was boiling up, and was all black and dirty, and it stunk frightfully.

1968. (*Mr. Harrison.*) Can you tell us what the chemical process is by which upon the application of water to the iron pyrites the sulphate of iron becomes soluble?—The oxygen enters into combination with the pyrites, and forms an oxide, which becomes soluble, and it is washed through in a liquid form into the cellars.

1969. The sulphuret of iron is changed into a sulphate?—Yes.

1970. This process which you adopt is of a somewhat similar character to that which takes place with sulphate of iron. The oxygen is gradually taken up by the iron pyrites?—Yes.

1971. By the sulphuret of iron?—Just so. I have dyeworks as well, but I do not work them. They are worked by Messrs. Benton.

1972. (*Professor Way.*) Do any means occur to you of dealing with the river?—I think that it would be the grandest thing which could be accomplished if a national scheme could be carried out, and an immense drain made through the valleys similar to what has been done in London with the great sewer, separating the sewage from the Thames.

1973. (*Chairman.*) You would take some means by which the entire valley could be purified?—Yes.

1974. And every work upon the river benefited?—Yes.

1975. How is the Ings Beck polluted?—By refuse from dyeworks below my premises. Above my premises it is pretty clear and good.

1976. The dyeworks turn in all their fluid refuse?—Yes.

1977. (*Mr. Harrison.*) All those below you?—Yes.

1978. But you do not do so yourself?—We do from our dye-house below.

1979. (*Professor Way.*) But you are not working there?—No, but it goes from there.

1980. (*Chairman.*) Do you know a single dyeworks in all Yorkshire which is not polluting the water in some way or other?—No.

1981. Is there anything further which you wish to add?—No, except that it would be most desirable if some scheme could be adopted to prevent the fouling of the rivers in the manner in which they are fouled.

The witness withdrew.

Adjourned to to-morrow at 11 o'clock.

Wakefield, Friday, 19th October 1866.

PRESENT:

ROBERT RAWLINSON, ESQ., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, ESQ. | Professor JOHN THOMAS WAY.

T. Spencer, Esq.

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THOMAS SPENCER, ESQ., further examined.

1982. (*Chairman.*) Would carbide be a cheap and efficient mode of purifying refuse from chemical works, bleach works, and dyeworks?—If, in the first place, the sedimentary matter is made to subside, and the impure water afterwards passed through the carbide, it would.

1983. That is to say, water chemically impure, but deprived of its mechanical impurities?—Yes. I know of no water so impure that might not thus be rendered harmless if allowed to flow into the river after passing through a carbide filter.

1984. Have you ever tried carbide upon substances such as those contemplated, chemicals or dyes?—Yes.

1985. Have you tried it on port wine?—That which I spoke of yesterday in reference to wine was a mere laboratory experiment, but I have tried similar experiments on a larger scale.

1986. Is the colouring matter in port wine analogous to the colouring matter in logwoods and dyewoods?—Yes; but several Lancashire manufacturers have within the last two years sent me specimens of refuse water, in order that I might form an opinion as to whether in the event of some measure being passed by the Legislature to compel them to get rid of the nuisance, there would be any mode of dealing with their refuse water; I found in all instances, with the exception of starch refuse, that the water might be dealt with, allowing in the first instance the matters in suspension to subside.

1987. From your wide experience in manufactures, and from having been consulted for chemical purposes, are you aware that there is any desire on the part of large manufacturers either to shirk the question, or to find out some means by which they may prevent pollution of rivers without ruin to their business?—All manufacturers that I have had to do with are desirous to do all they can; but they feel that it would be a hardship to be fined, or have penalties imposed upon them for creating a nuisance there was no possible way of avoiding; but they are anxious to know how nuisance may be avoided, and if avoidable they would adopt any means that were shown to them, provided that all were placed under similar conditions. They say, "if we are all made to row in the same "boat we shall get our expenses out of the public, we "shall charge more for our material."

1988. In other words, the price of the article must bear a proportion to the cost of producing it, and the purification process would be one more element in the cost of production and would lead to a corresponding increase of price?—Yes, that is what I believe their feeling to be.

1989. Did you hear the evidence that was given as to waste soapsuds?—I only heard the evidence given yesterday.

1990. Mr. Teall showed us that at the present time certain manufacturers receive for waste refuse produced from this soap washing sums of money equal to 100,000*l.* a year, and that to his knowledge at least double that amount of waste is going into the rivers still, because other manufactories are small, and the difficulty of collecting refuse there would be greater; but still he thinks that all that could be recovered, if it were made imperative upon manufacturers to go to an additional expense?—I believe it can be done.

1991. Twenty or thirty years ago refuse from gas works was of the most noxious kind, and was most profusely poured out; you are aware that now it is not necessary to send any refuse out?—Yes.

1992. People can utilize all of it, so that it shall not be a nuisance to their neighbours?—That has arisen greatly in consequence of the mode of purification by oxide of iron as compared with the lime.

1993. Is not purification of the gas by oxide of iron an everlasting process; you take it out, bleach it, allow it to re-oxydize, and then put it back into the purifiers again and again?—Yes.

1994. You cannot do so with the lime?—No.

1995. That, once charged with sulphur is spent and must be thrown away?—Yes, it takes oxygen from the atmosphere and becomes hypo-sulphite of lime.

1996. Is it carbide that is used to purify gas, or oxide?—The precipitated or the hydrated oxide which was patented by Mr. Hills, is now in use very largely. The carbide is also an excellent purifier of gas. Experiments were made with it in Liverpool, it was found to answer better than anything else; but they subsequently found that which I pointed out in my patent that bog-iron ore would also do, and now they use bog-iron ore and not Mr. Hills' precipitated oxide. The great object is to get rid of the sulphur—iron absorbs sulphur. The carbide also absorbs sulphur, and when taken out of the retort and exposed to the atmosphere for some time—I do not know even whether exposure to the atmosphere is necessary—but when it is taken out of the retort and allowed to cool down, the sulphur is found in little pin-head nodules—quite yellow nodules, they may be floated off by water, and then the carbide is ready to act as a purifier again.

1997. Is that sulphur commercially valuable?—It is; in Hills' process the sulphur is not got out in the same way; but the spent oxide, that is, the oxide that is filled with sulphur, is put into retorts and the sulphur is distilled out, or, by burning, a very excellent sulphureous gas is the result, and by that process sulphuric acid may be made.

1998. One could point to gasworks in the midst of populous districts using the lime mode of purifying, and as the only mode of getting rid of that lime now is by selling it for agricultural purposes, and the farmers will only take it when not busy with their harvest, or during seed time, hundreds of tons are accumulated in the midst of dense populations, which is a very great nuisance; would it be a hardship, in your opinion, to compel gas manufacturers to use the iron method?—Certainly not.

1999. Do you think the Government ought to enact that lime should be disused?—Yes, I do, for apart from its odour there is always a drainage from the rain that falls upon the lime heap which goes into the sewers and pollutes rivers. This is invariably the case whenever there is an accumulation of lime waste.

2000. What gas would be developed by washings of refuse lime-heaps flowing down the sewers and becoming mixed with effete matters from house drainage?—That depends very much upon circumstances. In Liverpool, gas refuse, before they took to the oxide of iron mode of purification, went down the sewers and did comparatively little harm until it came in contact with another sewer which contained the refuse of alkali works containing muriatic acid, and then came a most intolerable nuisance, which the town authorities were obliged to put a stop to; but gas refuse by itself, if it meets no reacting body as it passes down the sewers, generates no very foul gas, but it injures river water and kills fish. For when it gets exposed for some time hypo-sulphite of lime is formed, which is soluble, but this only adds an inorganic impurity to the water.

2001. Do any of those gases or fluids affect the brickwork of the sewers, or the stone, or the iron work, so as to be injurious—the fluids from chemical works, for instance?—Sulphide of lime in solution would affect the mortar of the sewer and tend to destroy it.

2002. Would it attack the iron?—Yes, the iron would become rotten without any rust, it would have become a sulphide of iron.

2003. Would it be completely rotten?—Yes, you might easily knock it to pieces with a hammer if thoroughly saturated with sulphur. When iron is exposed to the influence of sulphur its shape is not altered, nor its thickness, and looking at it one would believe it as strong as ever; but if it is struck even slightly with a hammer it will scale off.

2004. Do you think that, in the case of tubular bridges erected in the neighbourhood of chemical works, there is any risk from the corroding power of the sulphur?—Certainly, in an atmosphere in which sulphur exists iron will not last so long as it will in an atmosphere that is clear of sulphur.

2005. Is there any chance of separation taking place so unperceived as to lead to a sudden catastrophe?—The mischief would show itself, because the vibration that takes place from passage of trains would cause the sulphuretted parts to shell off.

2006. You think it is possible that by a combination of mechanical filtration with chemical filtration water from manufactories might be very materially purified before being passed into river and streams?—I am decidedly of that opinion.

2007. In your investigations of impurities, as regards rivers, do you find the fluid or the mud to work the greatest amount of injury?—I have known rivers with very deep beds of foul mud, and the water flowing over has been comparatively pure and odourless; but whenever anything happens to stir up the mud then comes the nuisance.

2008. The mud covers itself over with a skin, which forms a sort of gutta-percha protection to the rotten substance beneath?—To some extent that is the case, as the mud will be undisturbed if the water is at all deep. The top particles are always more in motion than those below. As far as my observation goes I have found that in deep rivers, even with a large proportion of mud at the bottom, water may flow over it comparatively pure.

2009. Have you ever seen the outfall of the Birmingham sewerage works?—No, I have not. I regard mud as peculiarly noxious in tidal rivers where it is stirred up and is exposed twice a day in consequence of the action of the tide. I believe that the nuisance complained of in regard of the Thames arose more from periodically exposed mud banks than from sewage flowing into it.

2010. Then, in purification of rivers, we must not only look to the purification of the fluids, but prevent sediment getting in and coating the margins between high and low water?—No doubt such would be the most effectual mode of cure.

2011. You have already stated that you would have no hope of rendering good service by your carbide unless mechanical impurities be first taken out of the water?—Yes. I proposed a system of filtration for the Birmingham sewage, which, however, could not be adopted because they had already made arrangements for filtering upwards. What I proposed to the Corporation was this, that they should make a thick filtering bed for ordinary filtration by sand and gravel, and then should place lower down a not very thick layer of carbide; the top layers would take off the mechanically suspended matter, and then the water

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flowing through the carbide would be purified so much that it might enter into the river without creating a nuisance, and after flowing in the river it might be used for dietetic purposes.

2012. Are you acquainted with the liming process?—I am.

2013. Has it occurred to you that the liming process for facilitating deposition might be used in combination with the carbide process subsequently?—It might, and I proposed it for the New River Company's works at Hertford. The town sewage is there limed before it goes into the Lee—the company are bound to do so by Act of Parliament. The solid matter subsides very effectually; but the water that flows from it is not good; unless it were put into the river largely diluted it would injure the water below, and would putrefy; it is therefore let flow through a goit about a mile and a half before it reaches the river. The goit is very full of vegetation, which is very difficult to get rid of, and it abounds with rats, but the water when it gets to the end of the goit is improved. Not many months ago I went over these works for the company with a view to use carbide, and I reported to them that there would be no difficulty if they chose to go to the expense, and no doubt, if pressed, they would.

2014. Do you think that anything of this kind could be done on a great scale, instead of leaving it to be done by individual manufacturers each for himself. Could you lime a large stream or a small river first and then pass it over a permanent bed of carbide in the shape of a filter?—That would be more a question for a well-practised engineer. If the engineering difficulties could be got rid of, I have no doubt whatever that the most impure water could be rendered harmless as far as fouling rivers is concerned.

2015. The liming process is applicable upon a small scale and upon a very large one, is it not?—Yes.

2016. Is it the fact that chemical experiments of that class are more effective upon a large scale than in a laboratory?—They are less effective in a laboratory.

2017. If the larger experiments are true in principle the result would be the more perfect?—Yes, certainly; when experiments on a small scale succeed, experiments on a larger scale succeed very much better, it is peculiarly so with filtration.

2018. The disturbing elements are much more largely diluted?—Yes, and there is more quietude in the water on a large scale. In manufacturing small filters the greatest care possible must be taken to get the filtration perfect, but not so much so with a large filter bed.

2019. If, for instance, we show that laboratory experiments attain to certain results in filtration, the result of your experience would be an effective answer to manufacturers who might say, "It is all "very well what you can do in a closet, we do not "believe we can do it at our works, as they are so "large?"—I say that the contrary is the fact, that the larger the scale upon which you work the better the results will be.

2020. (*Professor Way.*) That is, supposing that the superintendence is equally good in both cases?—Yes, though less is required on a large scale.

2021. Have you made any comparative analysis of any waters before and after filtration through your carbide?—In every case in which I have been consulted by water companies or others with regard to carbide filtration, I have asked for a sample of the water to be treated, or whether they have had any previous analysis made, so that I might be capable of judging of the effect produced by the carbide. In several cases analyses made by others have been furnished to me, and in others I have been asked to make an analysis myself of the water previous to and after filtration; and I have returned a report of results in both instances, and have advised the same to be done by others, so that my analyses might be confirmed. This was so with regard to Wakefield, Spalding, and Rugby.

2022. Can you lay your hand on any of those comparative analyses?—I have copies of them all.

2023. Will you be kind enough to send to the Commission copies of them?—I shall have much pleasure in doing so.

2024. Can you in any instance in which your material has been employed state from memory about the quantity of organic matter found in the water before filtration and the quantity found afterwards?—In the Wakefield water, in the first sample that I analysed, as far as I can recollect, there were before filtration very nearly three grains of organic mater, and in subsequent cases I have found even from four to five after sand filtration. I have again found one grain, sometimes a little less and sometimes a fraction more.

2025. You speak of the water at that time supplied to the town?—Yes.

2026. There was a possibility, was there not, of that water being in a specially bad condition at that time from local accidental causes, such as drought?—Yes.

2027. I wish to know whether you have examined the water that was actually going into and the water that was at the same time coming out of the filters?—I have done so, and found that the organic matter was from one to two grains less in the one case than in the other; but perhaps the analyses made by Professor Clarke and Mr. Brand for the corporation of Liverpool might afford a better reply. The Rivington water, while the reservoirs were being matured, that is while the roots of the grass which formerly covered the soil at the bottom of the reservoirs were being dissolved, contained a very large quantity of organic matter, and samples of it were sent to Professor Clarke of Aberdeen, and also to Mr. Brand in London, with samples of the same water filtered through carbide. Dr. Angus Smith was associated with me in the inquiry, and Professor Clarke reported that he could hardly find a trace of organic matter in the filtered water, and Mr. Brand reported that there was something under half a grain, as nearly as I can remember.

2028. That was filtration through a small filter?—Of about a yard square.

2029. That would of course demonstrate the power of the material for effecting the object?—No doubt.

2030. But it would not clearly demonstrate the feasibility of it on a practical scale as a matter of quantity and expense?—That is so. But subsequently we made an experimental filter containing a surface of 25 square yards to test the same water during the controversy, for there was a great controversy in Liverpool with regard to the water supply at the time. This filtered water was analysed by a great many, for everyone who had an opinion that the water was bad got his own chemist to analyse it, and they all concurred that the water after filtration was very free from organic matter. During the period of the maturing of the reservoir, the water, as it went into the filter, was full of suspended organic matter; it was very brown, and was a source of great complaint in the town; but the water that came out of that filter was practically free from organic matter, and perfectly clear and colourless, and that filter worked for eight months night and day, and gave about 18,000 gallons daily.

2031. That was also an experimental filter in which the quantity you could economically pass through was not kept in view?—It was fully kept in view; we had only a layer of six inches of carbide; the engineer took care that there was not more carbide in the filter than what was intended to be used practically; in fact one important object was to test the quantity and quality of carbide that would be necessary for the larger beds.

2032. Do they continue that filtration?—They do not.

2033. For what reason?—The bottom of the reservoirs became cleaner as the grass rotted I suppose, and the water got very much brighter, and it became unnecessary to use the carbide as they considered, and

as I had previously reported to the Corporation would be the case.

2034. Is the water in the Liverpool reservoirs now at all covered with weed?—Yes, to some extent.

2035. Does your substance remove weed?—That is almost its greatest virtue. It prevents its formation by destroying organic matter on which it feeds.

2036. You think the Liverpool people are wrong in not continuing to use it?—I think they ought to use it, as the water is brown from peaty formations over which it flows.

2037. Does not it strike you that the answer to any doubts in regard to this town would be a careful analysis of the water as it goes into the filter and as it comes out?—Yes, it would, though not altogether so, because the carbide does even more to the water than taking out the organic matters. It oxidizes any gases that happen to be in the water arising from organic matter, and which ordinary analysis overlooks. Hence the peculiar and almost sweet taste that the carbide filtered water has. I may illustrate this by reference to another land. Perhaps it may be new to you to know that in Egypt there is 18 per cent. of magnetic oxide in almost every yard of the soil which is periodically covered by the Nile. During the last two years I have had a large number of samples of the soil of Egypt from various depths sent to me, and I may say that magnetic oxide abounds in every inch of the soil; I find at the very least 15 per cent. of magnetic oxide. I was led to this inquiry from the ordinary opinion that the fertility of Egypt arises from the mud of the Nile. I have had numerous samples taken at the time of overflow from the Nile in which I found very little organic matter indeed, but in the sediment there was a very large proportion of iron; though at that time I did not observe that it was magnetic iron. Since then I have made many analyses of the waters and examinations of the soil, and find it to be as I have stated. This accounts for the healthiness of Egypt, even when the Nile subsides; in other lands, if you allowed so large a surface of wet mud to be exposed it would breed malaria. Hence, too, it is that the waters of the Nile are so much liked for drinking, and that they are termed "The sweet waters of the Nile," The cause of the magnetic oxide being in the Nile waters is no doubt the gradual disintegration of the trap rock in the upper regions of Africa. Trap rock contains from 20 to 22 grains of magnetic oxide when analyzed.

2038. If you were to find that the water in the Wakefield reservoirs, being tolerably free from organic matter, was not sensibly affected by filtration through your carbide, would that be what you would expect?—If there were only a small quantity of organic matter in the water to commence with, still there would be a smaller quantity after filtration under all circumstances.

2039. You mentioned one grain; suppose you began with five grains of organic matter, you might by carbide filtration probably bring it down to one grain?—Yes.

2040. Suppose you began with one grain before filtration, what would you expect it to come down to by filtration?—Something like half a grain, because a small quantity of organic matter in the water is far more difficult to separate. But then that small quantity is in all ordinary cases harmless; it is the large proportions that become putrescent—those very small quantities that seem to be in the very interstices of the water have no injurious effect whatever.

2041. (*Chairman.*) I suppose that in chemistry it is the same as in agriculture, the ordinary progressive laws of arithmetic do not apply?—They do not; at least in this case it is a sort of inverse geometrical progression.

2042. Again, I suppose the same rule holds good, that if there is a difficulty in a small experiment, that difficulty is diminished if, with equal care, a large experiment is conducted?—No doubt, in most chemical operations.

2043. If any person asserts that the carbide hardens the water of Wakefield in filtration, what would be your reply?—In the first place, that the carbide does not harden water, but has a contrary tendency; but that the water at Wakefield is slightly hardened I know, and in my report to the company I told them that they must expect that for the first 12 months, because the reservoirs were new, and the iron from which the carbide is manufactured always contains some little sulphate of lime, and the more porous the material is in itself, the longer time it takes before that sulphate of lime is washed out; but when it is washed out the carbide does not harden—it cannot harden—it would be a chemical impossibility for carbide to harden water; but in all cases for the first two or three months carbide filtration is liable to add, to the extent of a degree or two, to the hardness.

2044. Is it necessary to treat the raw carbide by any bleaching process before putting it into a filter, to help to sweeten it?—No, not if you allow the water to run to waste for some seven or eight days. When our first filter bed was opened at Wakefield the water that first passed through was very bad; and in order to help the washing process I recommended that alkali be used, and we spread some soda ash upon the top and let the water go through; the purification of the carbide took place much sooner.

2045. That facilitated the purification of the foreign matter?—Yes; and had there been no outcry in the town regarding the state of the water, I should have let it go to waste without using alkali.

2046. (*Professor Way.*) With regard to hardness, do you know what the hardness of the water of the river Calder is at this moment?—I do not; but I think from 7° to 9°.

2047. Would you not be surprised to hear that in July it was between 8° and 9°?—No.

2048. What is the degree of hardness of the water which is usually supplied to the town by the company?—I forget exactly; but Mr. Sykes will remember my report of the last samples. They do not send me samples often; that is a matter of expense.

2049. If you found that there were from 8° to 8½° of hardness in the water you supply, would you say that you had hardened the water?—If the filtered water is harder than that which goes into the filter from the river, of course I must say so. Still I should repeat that if it is so the carbide is not thoroughly cleansed.

2050. (*Chairman.*) Have you anything further to add?—I do not know that I have. I may say that I omitted to state yesterday that the carbide has the effect of taking sulphuretted hydrogen out of water where it exists; that is a certain result.

The witness withdrew.

The witness subsequently forwarded the following letter:—

32, Euston Square, London, N.W.,
October 20, 1866.

GENTLEMEN,

I TAKE the liberty of writing to rectify a couple of circumstances in reference to the Wakefield Waterworks, one of which was, I believe, omitted from the evidence, and the other inadvertently misstated. To each, however, I attach some importance.

From what I gathered in the course of the evidence given while I was present, it appeared to me that you had not been previously informed that the town supply was first passed through a cocoa-nut fibre filter, and then through one of sand and gravel for years previous, and up to the period when the present carbide filters were completed.

On my first visit to the Company's works in, I think, 1860, I found, along with the cocoa-nut fibre arrangement, a regularly constructed filter of sand and gravel in full operation. I believe it had been planned by Mr. Simpson. At all events these arrangements were in operation during all the previous outcry as to the impurity of the water. The filter bed stood partly on the site of those now constructing.

I would here add a word in regard to the subsiding reservoirs near the river. The suspended impurities of this

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water are not such as readily subside. They contain a considerable proportion of organic substances. My reason for advising the construction of the dividing wall was that one division of the reservoir might be cleansed while the other was in operation. At the same time no cleansing of either has been found necessary since the alteration.

At the time the water was pumped out to make the wall, I was much surprised to find that barely 6 inches of mud had accumulated in so many years. I expected to find more than twice this quantity. However, this latter fact tends to show that the impurity complained of is at least as much due to chemical as to mechanical matters. In pumping this subsided water in dry weather up to the filter beds, I have known of the man at the lift being obliged to leave off work after discharging the contents of his stomach, caused by the intolerable odour of the water.

The second point I have to refer to is in regard to the quantity of carbide now in the filter beds, about which you may remember there was some misunderstanding between myself and Mr. Sykes. I gave, in my evidence, that they contained 9 inches. This statement was corrected by Mr. Sykes, who was then under the impression that they contained 12 inches. This, however, is not so. After the close of the inquiry we ascertained that the first statement is correct, viz., that these beds contain 9 inches of carbide and not 12 inches. It is true that the layer containing the carbide measures 12 inches, but it is mixed with three inches of coarse sand. The mixture was made whilst putting it in the beds.

Had the matter rested with me I should certainly have used not less than 12 inches of carbide alone in dealing with water so impure, and especially when nearly twice the quantity is passed through that I intended. When, however, the other beds are in operation, this will be amended.

At Rugby there is less than 3 inches of carbide in the filter bed, whilst twice the quantity of the impure river water is passed through that ought. Still, all parties seem contented with the water, and when I remonstrated as to the inadequacy of the quantity of carbide to effect thorough purification, I was told there were no funds to purchase more.

As I do not charge any royalty for patent right, but include it in the price of the material, you will see that my motives are liable to be impugned when I urge the necessity of having a larger quantity, or at all events what is deemed to be a large quantity.

I am, &c.
(Signed) THOS. SPENCER.

To the Rivers Commission,
&c., &c., &c.

Col. J. G. Smyth.

Colonel JOHN GEORGE SMYTH (of Wakefield) examined.

2051. (*Chairman.*) Do you reside in the vicinity of Wakefield?—Yes, I reside at Heath, near Wakefield.

2052. Have you resided here for some time?—Since the year 1837.

2053. Do you remember the condition of the river at that time sufficiently to be able to speak as to the alteration that has since taken place?—When I first came to reside at Heath the river water was, comparatively speaking, perfectly pure, and an angling association existed, and the fish were carefully preserved. Trout were caught very near to my house; but at this moment I do not suppose that fish can live in the river; it is very foul, and during the summer season it is most offensive; there is a thick scum on the surface which in hot weather smells, and is, I have no doubt, injurious to health. I have heard persons complain of sickness, which they attributed to it.

2054. Are you a riparian owner?—Yes.

2055. Do you believe that this state of things deteriorates the value of your estate or otherwise?—The occupiers of land suffer very much, and the water is useless for cattle; to that extent the pollution of the river deteriorates the value of the land; it deteriorates it for residential and agricultural purposes.

2056. Are you one of the Aire and Calder undertakers and proprietors?—Yes.

2057. Do you exercise over the rivers any police or other authority to prevent pollution of any kind?—No, we have no power of that description.

2058. It being admitted on all hands that the river is fouled, and to a very injurious extent, do you think it is necessary that some properly constituted body should be entrusted with the management of the river, in order to prevent these pollutions in future, if they can be prevented without destroying the trade of the country?—Some legislation do you mean?

2059. Yes; that Parliament should place the power of prevention in some local authority who would see that it was carried out?—I have not the least hesitation in saying that compulsory measures of legislation are absolutely necessary.

2060. (*Mr. Harrison.*) Have the undertakers of the Aire and Calder Navigation power under this Act to prevent tipping into the river any materials that will interfere with the navigation of the river?—Certainly; and that power we exercise purely for navigation purposes, but not to prevent the fouling of the stream.

2061. (*Chairman.*) Are you aware whether the sewage of the different towns and places is passed into the river?—I believe that the sewage of many large towns higher up the Calder than Wakefield passes into the river.

2062. That would be one of the causes of impurity that ought to be prevented if possible?—Certainly.

2063. Fluid refuse from dyeworks and chemical works also passes in?—Yes.

2064. It will also be necessary to prevent that form of nuisance from going into the river?—Quite so. In conversation which I have had with various mill owners on the Calder above Wakefield, near Halifax, and elsewhere, I have found that they all concur in the necessity for some measures being passed; but every man says that it is hard that he should be punished and his neighbour left unpunished; that whatever legislation takes place should be compulsory, and carried out strictly by some independent body, and should be equally applied to all cases of nuisance. I believe the general feeling is that no refuse or sewage should be allowed to be discharged into any of the streams in the West Riding of Yorkshire. The streams flow into the rivers, and are used by the inhabitants in small places for domestic purposes and for cattle; and if those small streams are fouled the larger ones become equally and indeed more fouled.

2065. (*Mr. Harrison.*) What are the limits of your jurisdiction upon the Calder as undertakers of the Aire and Calder Navigation?—Up to Wakefield, and upon the Aire up to Leeds.

2066. You have the power to prevent ashes being thrown into the Calder within your jurisdiction, but you have no power over manufacturers in the neighbourhood of Huddersfield and other towns?—None.

2067. It was stated yesterday that a large quantity of ashes are found in the bed of your river, and that the undertakers are put to considerable expense in dredging in order to remove those ashes. Those ashes, I presume, have been thrown in at points above your jurisdiction, and have come down?—I imagine so.

2068. The undertakers are pecuniarily interested in an extension of the power of prevention to the upper districts as well as to those over which they have jurisdiction?—Quite so. There is water communication higher up the river than Wakefield by the Calder and Hebble Canal; but that, although it is now united with the Aire and Calder, is not part of the Aire and Calder Navigation.

2069. Have the undertakers of the upper navigations similar powers to prevent the tipping of ashes in?—I believe they have, but I cannot speak confidently upon that subject.

2070. (*Chairman.*) I believe you act as chairman of the county magistracy in this district?—I am chairman of the petty sessions division.

2071. Do the county police exercise under your jurisdiction authority over nuisances in villages; I mean, do they act as inspectors of nuisances?—Yes, they do in some instances in the small villages exercise authority.

2072. Are you acquainted with a recent Act of Parliament called the Public Health Act?—I know that Act.

2073. I believe that that has enlarged the powers of magistrates?—It has.

2074. In the event of a legislative enactment to prevent the fouling of rivers, do you think that, instead of a new jurisdiction being set up, the police might be made available for the purpose of giving information as to offenders against the Act?—I think that the police in all cases would be useful as informers both in boroughs and in counties. In a town like Wakefield there is an inspector of nuisances, whose business it is to report upon those nuisances. No such officer exists in small towns; and there I think the police might be employed as you suggest. I have also thought that in small villages the surveyor of highways, who is a responsible officer in every township, would be a very proper person to see any nuisance removed.

2075. (*Mr. Harrison.*) At the present time it requires some of the people who suffer from nuisances to give information?—Yes.

2076. That is frequently considered an invidious duty to perform; persons neglect it, and the nuisance continues?—Yes.

2077. You would remove that difficulty by making it the duty of a public officer to prosecute?—Yes. In my own village I have carried that out to a certain extent, and I think with very great advantage. There is no doubt that one neighbour dislikes to say anything disagreeable of another; but when it is made the duty of a public officer, and somebody sees that he performs his duty, he cannot be accused of invidiously selecting one man for prosecution.

2078. (*Chairman.*) The interests of the river, as the population has increased, now have come to consist of the interests of riparian landowners, of riparian manufacturers, and of riparian villages, towns, and boroughs?—Yes.

2079. If a board of conservancy is to be set up, do you think it would be advisable that the members should be elected by the parties representing all those interests, instead of the management being entrusted to any one set of officers, as the county magistrates or the borough authorities?—Perhaps some arrangement might be adopted like that of the Salmon Act of the last session of Parliament.

2080. How is that board elected?—It is elected first of all by the magistrates, and by parties having property on the spot, who form a fishery board, and they have power to prosecute. Under the Salmon Act the magistrates' duty is to communicate with the Home Secretary, who sanctions, upon application, the formation of a fishery district and then puts the Act of Parliament into operation.

2081. In the case of the Aire and Calder, should not legislation provide that persons in the locality should petition one of the departments of Government to set up an authority, and that that authority should be not a mere central authority, but a local authority, to be elected locally, with provision for an appeal in case of neglect to a central authority, which should compel the local autority to do its duty?—I think there might be a difficulty in any district in obtaining the unanimous opinion of the parties with regard to what was considered a nuisance. I would rather see some compulsory legislation that should forbid the discharge of anything like sewage into the rivers, and I would have the same legislation as to smoke. The magistrates on the spot in a borough, or a stipendiary magistrate, which many of these large towns have, or ought to have, and in small districts the county magistrates, should be compelled to carry out the law.

2082. Are you aware of the provisions in Lord Derby's Alkali Act?—Yes.

2083. That Act was passed for the prevention of the discharge of alkali vapour beyond a certain percentage?—Yes.

2084. All works are put under absolute control and inspection?—Yes.

2085. And the Act is working satisfactorily, that is to say, the manufacturers are working harmoniously with the government authorities, and are carrying on their manufactures, and sending out a very much less proportion of impurity than the Act allows them to do?—I understand that that is so, and the Act I believe is most successful.

2086. Do you think if a provision of that kind were made, it would be better than leaving the matter to the local authorities?—I should hesitate before I placed any large authority of this description in the hands of local authorities. The duty should not be thrown upon the local authorities to be the first movers. I would rather have compulsory legislation. My experience tells me that the only way in which a restriction of this kind can be carried out effectually is to make the legislation not permissive but compulsory, and to make the restriction part of the statute law of the country.

2087. Smoke Acts have been passed I believe by Parliament for some years past?—Yes, I helped to carry the Leeds Improvement Act through Parliament some years ago, in which there was a smoke clause, but I believe it is totally inoperative.

2088. I presume you think that the makers of the nuisance should not have committed to them the duty of preventing it?—I think that they should not be the first movers in the matter in order to compel the removal of the nuisance.

2089. If it is left to them you think it may remain a long time without being removed?—Yes.

2090. In the original Act of Parliament of William the 3rd, besides the undertakers of the Aire and Calder Navigation, Commissioners were appointed whose duty it was to settle disputes between the undertakers and the millowners, the riparian proprietors and others. In the Act of 1774 the same Commissioners appear to have been in existence, and a number of Commissioners were added to them, with similar duties. Are those Commissioners still in existence?—They are, but an appeal to the Commissioners is very rare. I hardly remember one.

2091. Who are the Commissioners now, or are they known?—I cannot state the names to you; they are known, but the fact of their duties being so light probably accounts for my not being able to name them to you. They are named in the original Act of Parliament.

2092. If you look at the list, in this Act you will see that it occupies much more than one page of this Act?—I can only tell you that such a body exists, but that within my recollection they have never been called upon to act.

2093. If a law were passed to prevent the pollution of the river, would the resuscitation of that body be desirable, and would the body be adequate to the discharge of the duties of carrying out the Act?—If the duty is to be done, it should not be entrusted to so large a number as those whose names are printed on this page. I would rather have two persons who would do the work than an Act of Parliament full of names.

2094. (*Chairman.*) In your practical experience of the working of Acts of Parliament do you find that large bodies work as well as small bodies?—Certainly not; the smaller the body the better for working under any circumstances.

2095. The work must devolve upon two or three?—Yes, practically it always does.

2096. And if you have a large body their only efficiency in a general way is for mischief, namely to come in and upset something which the small body has done?—That is frequently the case.

2097. (*Mr. Harrison.*) In the appointment of any new body as a Conservancy, would it be desirable to repeal so much of the Act as went to appoint the present body, and to throw the duties of the present Commissioners upon the new body, and to let them carry out along with those old duties the duty of seeing that the river was not polluted?—Are you now speaking of the river Calder only?

2098. The Aire and Calder.—I take it that any Act which the Legislature will pass must be a general Act, applicable not only to the West Riding of York-

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shire but to all parts of the kingdom. I would much rather have a general Act applicable to all rivers than an Act applicable to the Calder, or to the rivers Aire and Calder, and another Act applicable to the river Derwent, and another applicable to the river Ouse, probably clashing with each other, and making a confusion which would be worse than the present state of things.

2099. (*Professor Way.*) Would you be able to wait for that?—I hope that we shall not have to wait very long, because if so the inhabitants who live on the banks of these rivers will cease to exist.

2100. The circumstances and necessities of one district may not be exactly like those of another?—But the Act would only apply to the nuisance which existed.

2101. Did I rightly understand you to say that supposing legislative measures to be taken with regard to the pollution of rivers, you would prefer that they were carried out through the medium of a central or of a local authority?—By "central" do you mean a central authority in London, or a central authority in the district?

2102. A central authority in London.—I think that whatever the law directs should be carried out by those on the spot. There is no difficulty in carrying out the law if once made. I would never leave the question of a nuisance to a common informer.

2103. Would you like a Conservancy to carry out the legislative enactment, or would you prefer its being done by officers resident upon the spot?—Whatever law exists must be put in motion, I imagine, by those on the spot who can obtain the necessary evidence, and for that purpose a body of conservators, or even a local board, would be sufficient. In country districts, where no local board exists, the superintendent of police or sergeant of police would be quite fit to move in the first instance.

2104. You I suppose would embrace the whole river under that provision?—I should embrace every river which was a nuisance, into which was discharged sewage or anything which created a nuisance.

2105. (*Mr. Harrison.*) And it would be the duty of the superintendent or sergeant of police, or even of a policeman, through the superintendent to become the informer?—Yes.

2106. Action would immediately ensue, and the case would be followed up before the magistrates?—Yes; and in order to carry out the same system by the police with regard to nuisance from bad drainage of houses, it should be the duty of the constable to report the nuisance, and some officer should have the power of enforcing the removal of it.

2107. (*Chairman.*) Assuming that some machinery is invented, and the process defined, there is the question of payment. Do you think that the county or the counties affected would resist a small rate for this special purpose to be collected with the county rate?—I think not.

2108. All parties, manufacturers, towns, villages, and town property, should be rated, and the rate should spread itself as equally as the benefit to be derived?—I think that all parties would willingly contribute their proportion to a rate for that purpose.

2109. You, as a landowner, would not object to an equitable rate for the purpose, supposing that you were to get the benefit in effective legislation for the prevention of the nuisance?—I think that there would be no objection whatever on the part of either landowners or millowners.

2110. (*Mr. Harrison.*) Do many salmon come up the Humber?—Salmon come up the Humber and up the Ouse, to within five or six miles of York.

2111. Have you heard on any occasion of injury being done to the salmon in consequence of the polluted state of the Aire and Calder, or other rivers?—No salmon come up the rivers Aire and Calder.

2112. I mean in the waters discharged by the Aire and Calder into the river below, into the Ouse?—I cannot say that I have heard of injury being done to the fish, but you are aware that the Ouse is a very broad river where the Aire flows into it below Selby.

2113. You have not heard that during this year in the Ouse, below its junction with the Aire and Calder, salmon sickened in consequence of the discharge of those rivers and were brought to the surface and caught in great numbers?—I was not aware of it.

The witness withdrew.

Mr. J. Rhodes.

Mr. Joseph Rhodes (Mayor of Wakefield) further examined.

2114. (*Chairman.*) Do you to know whether there are many unformed and unpaved street surfaces in the neighbourhood of Wakefield?—Yes, there are many, but I think that our town clerk or our surveyor would answer that question better than I can.

2115. Have you borrowed any money for improving your roads and surfaces?—Not for roads, only for sewers; not for finishing the surface.

2116. Supposing the unpaved streets to be private streets, still as a local board you have power to give notice to the owners, and in default of their doing their duty to enter and to do that work and to borrow money for it?—It is very probable that we shall adopt that plan next year or the following year, after we get our main sewers completed. We are now going on with the main sewers with energy, and I hope that we shall finish off the matter by paving and flagging the streets.

2117. There are now a great many streets and roads which in wet weather must be almost impassable?—I am very sorry to see them, but still we must make the sewers before we can finish the roads themselves.

(*Mr. Morgan.*) I may be allowed to state that when the corporation became a local board of health, the old commissioners had 27 streets which they sewered and repaired. Since that time the local board of health have compelled the owners and occupiers of about 30 streets to sewer, pave, and channel; and I believe that some of the roads to which you refer are private roads, and the local boards do not wish to compel the owners to pave and sewer until the system of drainage is carried out.

2118. With your streets in the condition in which they are now, the mud a foot or two deep upon the surface during heavy rains, a portion of the mud is washed down from the surface and gets into the rivers and streams. The state of the streets, therefore, tends to the pollution of rivers, besides occasioning inconvenience to your own inhabitants and the district generally?—There is no doubt that that is the case.

(*Mr. Thomas Mark Carter.*) I am a brewer in Wakefield. There have always been two opinions in the Wakefield Town Council as to whether it is better to borrow money or to be a little more patient. Each of them has found very strong defenders, but I have always myself been of opinion that it is much better not to go into debt. In the first place, I am quite willing to pay for my time and generation, but I do not want to pay more. In the next place, the streets are being cut up to such a degree for repairs and sewerage that it is very disagreeable to those living there, and I think that we are going as fast as is beneficial. In the next place, I object to the quantity of sewage which has been deposited from the town into the river. They are constantly making more sewers and are constantly causing more sewage to run into the river. I wish that they would not take it there, but would remove it elsewhere as dry sewage. I very much dislike its running into the river, except on the condition that the rivers and streams of the West Riding which form the Calder shall all be considered as open drains and sewers. Eight years ago, I, wanting pure water, went up the river Calder and with great care examined every side stream coming

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in; I found that every one was taken advantage of by the proprietors on the banks to turn their dirty water or refuse into. I went up the river till I came to the hills past Todmorden, where the stream became only the thickness of my leg, and there as I passed the homesteads I saw almost every one had a privy overhanging the river. As I was looking on a woman went to the stream with a shovelful of ashes from her cottage and threw them into the stream. I then gave up the attempt to find any clean water. I saw the river was treated as an immense sewer composed of a great number of small sewers running into it. If it is considered that the river should not be so treated, then in my opinion the only other course is to make an artificial cut by the side of it.

(*Mr. Morgan.*) In the Act of Parliament applying the Public Health Act to Wakefield, there is a special clause empowering the local board to prevent the pollution of streams, but the clause has been inoperative in Wakefield as it has I believe in other towns. That Act passed in 1853.

Colonel John George Smyth further examined.

Col. J. G. Smyth.

2119. (*Mr. Harrison.*) You have just heard the observation of the deputy town clerk that the corporation of Wakefield have power to prevent the discharge of sewage into the river, and that they have not acted upon it. Supposing, as you proposed just now, the police of the county were constituted the informers of the breach of an Act prohibiting pollution of rivers, how would that operate in the case of sewage turned into a river by a corporation such as Wakefield?—Within the borough?

2120. Yes.—I imagine that the inspector of nuisances would then be the person to report the existence of the nuisance.

2121. Then the inspector of nuisances would have to report to the people who created the nuisance?—The corporation have an officer whose duty it is to report the nuisances, and he makes his report to the mayor, or to the board.

2122. But in the case which I put the corporation themselves are carrying out the sewage works. If the inspector of nuisances in the town of Wakefield were to be the informer against the pollution of the stream, there would take place what occurs in the carrying out of the Smoke Act—those who create the smoke in a town are the judges. How do you propose to remedy that?—Supposing that every borough in the West Riding of Yorkshire had the same clause, I am quite sure that Wakefield would carry it out; it is because one corporate body has it not, and another having it does not use it, that all are now equally backward in taking active steps to remedy what is a nuisance acknowledged by everyone.

(*Mr. Morgan.*) If we had attempted to put that clause into operation we should directly have come into antagonism with the authorities of the prison and of the asylum, a very powerful body who have the means of pouring their sewage down those very sewers, and there has been the difficulty.

(*Colonel Smith.*) No doubt you are under difficulty.

2123. (*Chairman to Mr. Morgan.*) You want that the power to prevent river pollution should be extended over the river basin?—It should apply to all running streams.

The witness withdrew.

Mr. William Ralph Milner (Wakefield) examined.

Mr. W. R. Milner.

2124. (*Chairman.*) Are you surgeon to the convict department of the Wakefield prison?—Yes.

2125. What points in this inquiry do you propose to speak to?—I can speak as to the state of the river, with which I have been acquainted since 1826, and also as to the state of the health of the prison, the sewage of the prison, and other matters connected with it.

2126. We have had in evidence that the river is very much more polluted than it was in 1826?—Yes, in 1826 the water was clear and the bottom was free from mud; it was a gravelly sandy bottom, and I have frequently myself sent stones into it for boys to dive down after; the water at a depth of seven or eight feet was sufficiently clear to distinguish stones at the bottom; some of the streams running in, for instance the Alverthorpe Beck, at that time were full of fish; there was a great deal of fish in the river. I have frequently seen kingfishers there, which shows the general clearness of the water. About 1850 the river began to be very much more polluted. I think that a material change commenced about that time, and the pollution has continued to increase since. The water is now dark coloured, frequently very offensive, and there are large quantities of matter floating upon the surface. The water with which we have been supplied at the prison is derived from the waterworks, which draw principally from the river. A few years since the water supplied was very offensive; in 1864 it was intolerable, the water stank; there were large quantities of matter deposited in the vessels in which the water was allowed to stand. The subject was brought before the magistrates and representations were made to the waterworks company; they then promised that the water should be improved, and lately steps have been taken to improve the water; it is now clear, bright, and free from offensive taste and smell, but very much harder than it used to be.

2127. It is harder than it was in its impurer state?—Much harder.

2128. What number of inmates have you in your prison?—To-day we have 1,245.

2129. Have you any reason to think that the water supplied is injurious to the health of the inmates?—No, I do not think that there is any injury which may be traced to the water supplied at present.

2130. Is the prison sewered?—Yes.

2131. Do the prisoners use soilpans or what apparatus do they use?—About 700 of the cells are supplied with waterclosets.

2132. With small waterclosets?—Fair-sized waterclosets, one in each cell; a separate watercloset for each prisoner. The remainder of the prisoners use soilpans which are emptied into the drains every morning; the pan is taken out (it is a most disgusting process) and emptied into the sewers. At one time it created a great nuisance in the prison, and I and the other medical officer had to complain of the nuisance; since then a quantity of disinfecting powder has been mixed with each stool, and the nuisance, so far as offensive smell goes, has been completely done away with.

2133. Does the whole of the refuse pass into the river?—The whole of it passes into the river.

2134. Have you ever contemplated, or have the magistrates contemplated, the utilization of that refuse matter?—The subject was discussed, and it was proposed that tanks should be made within the prison walls, and that some attempt should be made to use the sewage.

2135. To keep it out of the river?—Yes, partly to keep it out of the river, because the occupants of some neighbouring property objected to the sewage being poured into the Balne Beck, which runs between the prison and their property, and threatened to take proceedings against the magistrates. The question then arose whether a new sewer should be made to convey the sewage of about 400 prisoners into the river, or whether the sewage should be otherwise disposed of I must tell you that at that time Mr. Dunn, the

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medical officer of the West Riding Department prison, and myself objected to tanks being made in the prison; we thought that there would be such a difficulty in making them free from nuisance.

2136. You objected to setting up an apparatus for rendering the refuse putrid?—I believe so.

2137. With regard to the existing impurity of the river, has any mode occurred to you by which it would be prevented?—I see no other mode of remedying it except by shutting out everything from the river which pollutes it.

2138. Preventing the cause of pollution from going in?—Yes.

2139. Have you any other evidence to offer?—I merely wish to mention, with reference to the prison, for the purpose of showing the influence of good sanitary conditions upon health, that we have had since the Government prisoners were placed in Wakefield 8,947 prisoners, who have passed through my hands in the period of 19 years. The deaths have been ·9 per cent. during that time. I ascertained some years ago, for another purpose, the death-rate in the various sick clubs in Wakefield; it was ·89 per cent., nearly the same as ours; but we have not had a single case of continued fever of any sort among the 8,947 men during those 19 years; there have only been two cases of dysentery during the time, and 21 cases of erysipelas.

2140. Have you had any experience of the disease which prevails in the parts of the town inhabited by the class of persons to which the convicts belong?—I have had experience of that. There have been many cases of various kinds of fever.

2141. Is the mortality higher?—No; out of prison the mortality among adult males is about the same as in. Another fact of importance is that in 1849 we had an outbreak of cholera in the prison. At that time during the month of January we had 1,337 prisoners who passed through the prison; of that number, about 270 were in the old prison, the remaining 1,067 were in the new prison. In the old prison, which was badly drained and badly ventilated, and not warmed—the ground upon which it stood being intersected with rotten sewers, so that you could not dig two feet in the ground without fœtid water rising—we had 27 cases of cholera among 270 prisoners; in the remaining nearly 1,100 prisoners in the new prison we had not a single case. We had a great deal of diarrhœa all over the prison, but after the outbreak had ceased it was found that in the old prison each prisoner had had 13 times as much diarrhœa as in the new prison; that is to say, that supposing each man in the new prison had been one day under treatment for diarrhœa, in the old prison each man had been 13 days under treatment for it.

2142. Would your experience point to this, that if towns were treated as well as gaols are treated in a sanitary point of view you might, humanly speaking, banish fever from towns?—I think so; we have extinguished it in the prison for 19 years.

2143. You have actually treated a number of individuals for 19 years and have not had any fever, but you think that those same individuals would have suffered from fever in the towns from which they came if left to themselves?—I am convinced that a large number of them would have died from fever if they had been out of prison.

2144. Then if you wanted to give a man of that class the best chance of life you would immediately put him in prison?—No, he would die of consumption then, instead of fever. A large number of prisoners die of consumption. Our mortality is rather higher than the mortality outside.

2145. And that mortality springs from consumption?—From tubercular disease almost entirely.

2146. How do you imagine that that disease is set up?—I think that it is from the confinement. Something may be owing to the want of light, and something, perhaps, to the bad habits of the men before coming in, and a great deal, I think, is owing to the monotonous state of their lives; it is a low state of life. There is another fact which is important. In March 1848 one of the sewers became blocked; a plank had floated down and obstructed the sewer. We have four wings in the prison, A., B., C., and D.; the drain which was stopped was the drain out of which the sewage from B. and C. wings flowed. The sewage of A. and D. flowed freely, being carried by another channel. In my monthly inspection on the 1st of March I found that the basements of two of the wings, namely, B. and C., were flooded with sewage matter which had flowed up. Steps were immediately taken to remedy it. I do not know how long the sewage had been there; it might have been there for two or three weeks; but I detected it on the monthly inspection. The water was drained off. Previously to its being drained off we had not much sickness, and no great quantity of diarrhœa; but as soon as the water began to be drained off diarrhœa began to appear, and in the course of that month we had 43 cases of diarrhœa placed upon the sick list in those two wings; in the other two wings there were two cases of diarrhœa, but one case was that of a man in a consumption, and therefore inclined to diarrhœa; in fact he had had it for two months; so that we had 43 cases of diarrhœa in the two wings which were flooded by sewage, and only one case in the other two wings.

2147. As soon as you put that matter into a condition to evaporate more rapidly the disease increased?—Yes, as soon as the matter was exposed to the air.

2148. (*Professor Way.*) Would that have happened by effluence of time?—I think that it would, but I merely give the bare facts. I have kept a register of the rainfall during the time that I have been at the prison, which I should wish to hand in (*producing the same*).

2149. (*Chairman.*) These are the monthly results of a daily register?—Yes. There is another point which I will mention. A few weeks ago a portion of the water used in the prison for supplying the boilers and also for washing the vegetables was obtained from the Balne Beck; it became excessively offensive; a quantity of it was collected, and I have samples of it here. The water was very offensive to the smell, containing a great deal of sulphuretted hydrogen, and a great deal of vegetable matter. The Fibre Company were written to on behalf of the magistrates, and they stated that they would take measures to prevent any more of this water being poured into the Balne Beck, and it was done. This is a sample of water taken above the place from Balne Beck (*producing the same*). This (*producing another sample*) is water taken from a beck below where a drain from St. John's empties into it. This (*producing another sample*) is taken from the Yorkshire Fibre Company's outlet pipe.

2150. (*Professor Way.*) Do they use China-grass there?—Yes, I believe that that is the material which they employ. This (*producing another sample*) is taken from the pipe by which the water is conveyed into the prison from Balne Beck, and this (*producing another sample*) is some water taken from one of our cisterns; of course it is an accumulated deposit.

2151. Is the last sample but one the water which you now use for domestic purposes?—No, it was used merely for washing potatoes and for such purposes. For drinking we do not use that water, we use the Waterworks Company's water.

2152. (*Mr. Harrison.*) These samples have nothing to do with the town water supply?—No; except that the water, samples of which I have given, goes into the river ultimately.

2153. (*Chairman.*) I think you said that as regards its sweetness you had no fault to find with the water at present supplied by the Waterworks Company?—No, the water is free from unpleasant smell and taste; the only objection which I entertain is a fear whether—supposing that the cause of cholera is the presence of living organic matter in the water, which being conveyed into the system of human beings poisons it—the process of filtration employed at the water-

works will remove such organic matter. I have no doubt that Mr. Spencer's process will remove all dead organic matter; but it is very probable, and certainly possible, that it will not have the same effect upon living organic matter, and that therefore a quantity of feculent matter from cholera patients when poured into the river may produce cholera in persons drinking the water.

2154. (*Professor Way.*) Are they infusorial animalculæ?—No; I think that the evacuations of cholera patients contain nitrogenous matter and epithelium, which retains its vitality.

2155. Does any of the water of the Waterworks Company contain such matter?—I do not say that, I speak merely generally.

2156. (*Chairman.*) I suppose that you have seen in the London papers the statements made by the Registrar General, in which he attributes cholera to tainted water?—I have a very strong conviction that we take the poison in by our mouths, and that it is possibly conveyed from man to man by the water.

2157. Have you seen much of cholera?—Yes.

2158. And do you form your opinion after investigation?—No, it is more from my general information, and from a circumstance which I will mention. At the prison when we had these cholera cases, about one-third of the prisoners in the old prison by their occupations came more or less directly in contact with the cholera patients—for instance, all the washing was then done by men, and of course they came into contact with the soiled clothing—a number of other men were employed as nurses. We had an immense quantity of diarrhœa. Among that one-third of the men 14 out of our 27 cases of cholera occurred, whilst in the other two-thirds living in the same unhealthy prison we had only 13 cases; so that you may say roughly that 14 per cent. suffered from cholera who came in contact with the patients directly or indirectly, most of them being washers, while only six and a half per cent. had cholera who had been living in the same place and under the same unfavourable circumstances, except that they had not been brought into active contact with cholera patients.

2159. (*Professor Way.*) By infection coming through the mouth you mean respiration as well as drinking?—I think that if a man's hands are dirty from cholera emanations that contaminates his food.

2160. You said that those who came in contact with cholera patients died in greater numbers than those who did not?—Yes.

2161. In what way do you account for that?—Their hands get dirty.

2162. Do you mean that those who would otherwise have escaped had touched the cholera patients?—Yes, or their clothing. The amount of cholera was far greater, was certainly doubled among those who washed the clothes of the patients, or cleaned them, or carried them out, or acted as nurses.

2163. I suppose that that fact would generally be received as showing that the disease was infectious?—Yes.

2164. But you do not believe in that?—No.

2165. (*Mr. Harrison.*) Did the remainder of the patients in the gaol drink the town water?—They all took the town water.

2166. Then I presume that the persons who washed the prisoners' clothes did not drink any of that water after washing?—No, but they would not clean their hands. You may take an analogous case in lead poisoning.

2167. (*Chairman.*) Among plumbers?—Among plumbers and men engaged in lead works generally; if the manufacturers insist upon perfect cleanliness, and compel the workmen to change their clothes and clean their hands well and comb their hair before they go out, the colic is almost entirely done away with, whilst before those precautions were taken the number of persons killed or paralyzed by lead poisoning was immense. Here, I take it, it is the same—if the men get their hands dirty by cholera in any way the contamination comes into contact with their food, and they take it into their stomachs, and they suffer from it.

2168. (*Professor Way.*) Has it ever happened to you to keep a quantity of the water supplied by the water company in a glass vessel?—Yes.

2169. Does it show vegetation?—Latterly it has not done so, formerly it did very rapidly.

2170. When you speak of formerly, you mean before they began to use the carbide filter?—Yes.

The witness withdrew.

The witness subsequently furnished to the Commission the following paper:—

WAKEFIELD GAOL.

MATERIALS used in Manufacture, Dyeing, and Bleaching of Mats at the Prison.

A.—Raw Materials used *per ann.*:—

Cocoa yarn	580 tons.
Cocoa fibre	130 „
Spanish grass, Manilla, and other fibres	50 „
	780 tons.

B.—Materials used in dyeing and bleaching the yarn *per week*:—

Sulphuric acid	360 lbs.
Solution of chloride of tin	30 lbs.
Dye woods	6 cwt.
Sulphate of iron	36 lbs.
Alum	114 lbs.
Chloride of lime	4 cwt.

THOMAS G. WRIGHT, Esq., M.D. (Wakefield), examined.

T. G. Wright, Esq., M.D.

2171. (*Chairman.*) How long have you practised in this district?—Thirty-four years.

2172. How many epidemics of cholera have you witnessed in Wakefield?—Two in Wakefield.

2173. At what dates?—In 1849 there was a great epidemic at the asylum, a few months previously there had been an outbreak in the town, but there were then no cases in the asylum.

2174. In the asylum in 1849 what number of patients had you?—About 620.

2175. What water were they drinking?—Water supplied by wells and springs belonging to the asylum.

2176. Within the grounds?—Yes.

2177. Was the asylum at that time sewered?—It was.

2178. Was there any suspicion that sewage contaminated any of the wells?—That question was minutely inquired into, and in this book (*producing the same*) is the report of Mr. West, of Leeds, and Mr. Dawson, who were commissioned to make inquiries into the drainage and sewerage of the asylum, and their report is that nothing unfavourable was there found, that the drains were all in good condition and clear. At that time there were two cesspools where the solid matter was received and which were emptied periodically, those have since been done away with.

2179. Was any analysis made of the drinking water at that period?—There was.

2180. Have you a copy of that analysis?—No; but the result of the analysis was that it was a good pure spring water with only the ordinary proportion of lime which obtains in this district.

2181. Then the result of your examination was to show that, whatever the outbreak might be due to, you could not accuse the water?—Not at all.

2182. Can you form any opinion as to the cause of the outbreak?—This book is devoted to the subject.

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2183. Can we obtain a copy of that book?—I shall be most glad to place this book in the hands of the Commissioners; it is now some years old, it was published in 1850.

2184. Is it by yourself?—Yes. I may mention that I was for 20 years physician to the Fever Hospital of the town, that hospital was discontinued in 1853 because cases of fever had become so few that there not patients to require it; after the usual number of 70 or 80 cases in a year, we had not more than five cases in the last year, much less fever than prevailed for some years; of late it has increased again.

2185. During the prevalence of the cholera in the asylum did the cholera at the same time prevail in the gaol?—It had prevailed in the gaol in January 1849, it broke out in the asylum in September, and its greatest virulence was during October in that year.

2186. But it was not simultaneously in the gaol and in the asylum?—It was not. Out of 620 patients in the asylum 103 died from cholera, therefore the cholera was fearful.

2187. Was there cholera in the town at the same time that the asylum was afflicted with it?—I think that I have a record of one case of cholera in private practice during that autumn.

2188. Was there any cholera in the workhouse?—I do not recollect.

2189. Was the gaol supplied with a different water from that supplied to the asylum?—Yes.

(*Mr. Milner.*) We had the town's water in the gaol.

(*Dr. Wright.*) The asylum was not supplied with the town's water.

2190. Is the asylum supplied with the town's water now?—Yes, it is partly supplied with the town's water. The asylum is now increased to 1,200 patients, it had then only 620.

2191. Have you any reason to complain of the town's water now?—No; I use it in my own family and in my own dressing room; my wash-hand basin is supplied directly from the waterworks main, and therefore in using it every morning I have an opportunity of noticing it; it comes sparkling and clear now, it used to be very bad.

2192. Before the use of the carbide filter?—Yes. It is a little harder than it was, at least that is my own experience in using it for washing purposes; but considering the source from which it comes I think it is marvellously soft; the source cannot be commended.

2193. (*Mr. Harrison.*) Was the great impurity of the water previous to the year 1864?—Yes, and during the dry summer of 1864.

2194. Did not the water company then cleanse their subsiding reservoir?—Yes, alterations were going on then; it was during the progress of those alterations that the water was at the worst.

2195. And the company have taken other measures besides the use of carbide filters to give you a better supply?—Yes.

2196. So that the improved condition of the water may be partly due to attention to those points, as well as to the use of the carbide?—No doubt.

(*Mr. Sykes.*) I wish to make a correction in my evidence. I stated that these improvements were going on in 1862, but I find on reference to my books that it was in 1864.

2197. (*Professor Way.*) That was I suppose the time of the introduction of the carbide?—Yes.

2198. (*Chairman to Dr. Wright.*) Do you think that the cholera prevailed in the old workhouse?—I have no doubt that it did. I was not professionally engaged then.

(*Mr. Morgan.*) My impression, from what took place in the corporation, is, that it was in the workhouse in 1849.

(*Mr. Milner.*) I think that the outbreak in the workhouse was in the summer, intermediate between the outbreak at the gaol and the outbreak at the asylum.

The witness withdrew.

Rev. W. R. Bowditch.

The Rev. William Renwick Bowditch (Wakefield) examined.

2199. (*Chairman.*) To what points do you wish to speak?—Perhaps I can give you information which may be useful with reference to the outbreak of cholera in 1849 at the asylum. At that time I pointed out what I conceived to be the cause to the then medical superintendent, Dr. Corsellis. It was not a medical cause and therefore he had very little faith in it. At length he was quite convinced that they could not subdue the outbreak, and he said that they were willing to do what I suggested. I daresay you know that the asylum is situated upon rising ground. Their drainage falls to the south, and is then deposited in two large sump-holes. Whenever the wind came from the south the cholera became bad. Whenever the wind came from the north the virulence of the attack abated. The disease I told Dr. Corsellis was produced, in my opinion, by the decomposition of the sewage in these drains, the wind passing up the drains, and then freely into the building; and I told him that the cure for the cholera was to stop off this air current, to turn it up the chimney, and then to disinfect the place, and that I thought that if that was done he would have no more cholera. We met at the railway station, he threw away his ticket which he had taken, and went back and asked me if I would send up somebody to disinfect the place. These drains were then turned into an air-channel through the chimney, all the drains communicating with the building were trapped, and the building was thoroughly disinfected, upwards of 7 cwt. of manganese were used, and the asylum never had another case of cholera, so Dr. Corsellis told me.

(*Dr. Wright.*) This is quite new to me.

(*Mr. Bowditch.*) In my opinion the cause of the cholera was the partial oxidation of the sewage in the drains.

(*Colonel Smyth.*) That drain is closed now.

(*Mr. Bowditch.*) As soon as these emanations were turned up the chimney, instead of into the building, the cholera stopped and they never had another case.

2200. (*Mr. Harrison.*) What was the date of turning the gas up the chimney?—I know none of the details, I merely made the suggestion, the work was done by the officers of the Riding. I know nothing more than the mere fact that the cholera ceased as soon as the cause of the cholera (if it was the cause of it) was cut off. The fumigation was a mere auxiliary.

2201. What other points do you wish to speak to?—I heard Mr. Spencer's evidence yesterday, which I think went the length of stating that the carbide used liberally enough would destroy all organic matter in water, whether it was nitrogenized or not. That may may be the fact; but in Wakefield I do not think that they use it quite liberally enough, for the water at this moment, and ever since Mr. Spencer's process has been adopted, contains a considerable quantity of nitrogenized organic matter which will putrefy, and does putrefy, and smells badly. For instance, at present, if the water is put into a newly-washed decanter it always throws down a precipitate which putrefies.

(*Mr. Sykes.*) I may say that at the present time we are about laying down double the quantity of surface of filter. Since this inquiry commenced some stress has been laid on the fact that we have not had an analysis of the water previously to its entering the filters; I shall take upon myself to recommend our Directors to get a series of analyses, commencing with the river and ending with the reservoir. I have spoken to Mr. Spencer about it, and I think that we shall adopt that method, and if so I will forward to the Commissioners the result.

(*Mr. Bowditch.*) The water is sensibly improved, that is beyond a question, but there still remains a quantity of this offensive organic matter which it is very desirable to get rid of.

The witness withdrew.

Adjourned to Monday next, at 11 o'clock, at Dewsbury.

Dewsbury, Monday, 22nd October 1866.

PRESENT:

ROBERT RAWLINSON, ESQ., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, ESQ. | Professor JOHN THOMAS WAY.

DEWSBURY.

Mr. WILLIAM WOOD (of Dewsbury) examined.

Mr. W. Wood.

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2202. (*Chairman.*) You are the borough surveyor?—Yes.

2203. How long have you been surveyor to this borough?—I was assistant for three years, and have been borough surveyor for three years.

2204. What is the population of Dewsbury?—At the last census it was a little over 18,000.

2204*a*. Is it a growing place?—It has been growing at the rate of 800 persons in the year since I have known it.

2205. What is the amount of the present population?—About 20,000 now.

2206. What is the principal business carried on here?—Woollen manufacturing is the staple trade.

2207. Is water largely used for that purpose?—Yes.

2208. Is Dewsbury sewered?—Yes, it is sewered, but not completely; some drains are stone drains; what we have put down since I came here are made of brick, egg-shaped. We have laid down four miles of that description of drainage in six years.

2209. Where are the outlets?—We have six separate outlets in consequence of the irregularity of the surface, but they are all turned into the river.

2210. Do you remember the dimensions of those outlets?—They are three feet square as near as I can judge.

2211. Are they nearly all square outlets?—Yes, they are old-fashioned outlets.

2212. Are the new brick sewers connected with those old-fashioned outlets?—Yes.

2213. Are the sewers ventilated?—Yes, by manholes.

2214. Have you any plan of them?—No.

2215. They are made to plans are they not?—No.; we made them with our own men.

2216. With what do you cover them at the surface?—An iron grating.

2217. Can you remove that easily?—Yes.

2218. Who was the engineer who laid out the new sewers?—There was a plan before I came which seems to have been commenced and never completed. I never could find any sections of it.

2219. Do you know by whom the plan was made?—By Messrs. Turley and Rowell, of Bradford.

2220. Have you got the Ordnance sheet showing the sewers and outlets?—No.

2221. Could you not show them on a 6-inch Ordnance map?—Yes.

2222. What is the area of the borough?—1,468 statute acres.

2223. Is there a water supply for Dewsbury?—Yes.

2224. It is combined I think with the supply for some other places?—It is for Dewsbury, Heckmondwicke, and Batley.

2225. Are those places supplied under a private Act of Parliament?—Yes.

2226. Has there been any scarcity of water in the last summer?—No.

2227. I believe some of the works are not completed?—One of the reservoirs is out of repair, the embankment has given way.

2228. Have you any plan prepared for the complete sewerage of Dewsbury?—No.

2229. Are there many private streets in the town that are not paved?—Yes; but we keep constantly doing them; we have three or four on hand now, but a good few are not paved.

2230. What causes the filth near the railway station?—That is in consequence of the town not being paved. We use ironstone throws instead of sets; they are not fit for the traffic in Dewsbury, it is too heavy.

2231. You use ironstone in the shape of macadam?—Yes.

2232. Do you find any difficulty from that getting into drains and sewers and choking them up?—Yes.

2233. Have you had any complaints from the Aire and Calder Navigation of refuse passed into the river?—No.

2234. There is both a river and a canal here I believe?—Yes.

2235. Do any of the outlets discharge into the canal?—No, all into the river.

2236. Is the river navigable?—Partly so.

2237. Have no complaints been made?—We have not any drains that go in where it is navigable; they go in where it is not navigable.

2238. Have you noticed whether, after great rainfalls, banks have been formed where the outlet sewers discharge?—No, not anything of that sort.

2239. Have complaints been made by manufacturers of your sending sewage in and fouling the river?—No.

2240. Have you seen solids of any kind, such as foundation materials or ashes, thrown into the river?—I have seen what is called logwood refuse from the dyeworks. I believe that that is rather too extensively thrown into the river.

2241. Dyeing material, or spent water from dyeing pits, I suppose goes into the river?—Yes, all of it.

2242. Is there an inspector of nuisances in Dewsbury?—Yes; he is scavenger, inspector of nuisances and common lodging-houses.

2243. Are there many common waterclosets or soil-pans in the town, or are they all ashpits and middens?—We have a few waterclosets, but not many; ashpits and middens are principally used.

2244. Are the better class of houses and hotels provided with waterclosets?—Yes they are, I think, all of them.

2245. And the cottages, I suppose, have their cesspit and ash-heap?—Yes; there is a midden which is a little below the surface of the room, and a privy in connexion with it.

2246. Are the ashpits so close to the cottages as to cause a nuisance?—In new erections the local board obliges the parties to put them four yards from the dwellings.

2247. I am referring to the old ones; in what condition are they?—I believe they are pretty closely looked after by the inspector.

2248. Do you make stipulations, when you are surveying a place, as to whether there shall or shall not be waterclosets made?—We do not.

2249. Then if any person who is building cottages wishes to put up waterclosets in the place of middens, would any objection be made?—None whatever.

2250. Do you know how water is supplied to the cottages; is it supplied at a rental of so much per week?—Yes; so much a quarter. It is 2*s*. 2*d*. per quarter to the cottages.

2251. Is there a constant supply?—Yes.

2252. Then it is supplied, I presume, according to a rental to the larger houses?—Yes; it gradually increases, according to the size of the house, from 2*s*. 2*d*. to 5*s*. and 10*s*. per quarter.

2253. Are the ash middens emptied by men who are employed by the corporation?—The corporation has not taken that matter up themselves.

2254. Are they emptied by the individuals who occupy the tenements?—Yes; and if the nuisance

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inspector sees that they are neglected, he sends the scavengers cart and takes the soil away for them.

2255. At the cost of the corporation?—Yes.

2256. Have you seen any places where sewage has been applied to land?—I have not.

2257. Have you seen any places where sewage has been taken into reservoirs or tanks to get the solid material out of it?—No.

2258. Your attention has not been called to anything of that kind?—No.

2259. You are not at all aware that there has been any attempt made to prevent the cottagers using water-closets if they liked?—I have heard of nothing of the kind.

2260. Are any of the old cottages without any conveniences of that kind?—Yes; there are a few, I believe.

The witness withdrew.

Mr. T. Goodall.

Mr. Timothy Goodall (of Dewsbury) examined.

2261. (*Chairman.*) How long have you been inspector of nuisances?—Six years.

2262. What number of men are placed at your disposal?—Seven.

2263. Do you make any reports as to the nuisances you find to the town council, or the town clerk, or the health committee?—I make reports regularly every fortnight.

2264. What number of horses and carts do you employ?—I have at the present time one horse and one cart.

2265. In what condition did you find the town when you first began your inspection?—There was a great deal of filth.

2266. Can you mention the names of any places that were in the worst condition?—The worst place was at Daw Green.

2267. In what respect was that the worst?—Because there were many Irish people living there, and they do not keep their cottages as clean as they ought to do.

2268. Was the surface paved round about their houses?—No, it was unpaved.

2269. Had they any privy accommodation?—Yes.

2270. In what condition was that?—It was in a filthy state.

2271. Did they fill the privies up until the refuse ran over the floor and over the seat?—Yes, some of them.

2272. Was there any disease in those houses?—Not particularly.

2273. Has there been any fever in Dewsbury since you began your inspections?—Nothing to speak of. There have been cases, but nothing to cause any alarm.

2274. Has there been any cholera?—No.

2275. Does not typhus fever occur in the town in particular places?—We have, of course, some cases of fever, but we have never had such an outbreak as to cause any alarm.

2276. You think you are no worse than your neighbours?—No.

2277. Nor worse than Dewsbury was before?—No; I may say that we were never in a more healthy state than we are now.

2278. How long do you remember the condition of the river?—I have resided in Dewsbury between 40 and 50 years.

2279. Is the river dirtier now than it was when you first knew it?—Yes; it is discoloured by the dyeworks.

2280. Do you remember seeing fish in the river?—Yes.

2281. Did you ever catch any?—Yes.

2282. Do you believe you could catch one now?—I believe that I could not.

2283. Are any complaints made by manufacturers as to the foul state of the river?—I never heard of any; but manufacturers are the cause of it, and therefore they do not complain.

2284. Do you ever see any dead carcases floating in the river—dogs or pigs?—I have seen dogs and pigs too.

2285. If your men were to find any dead dogs about the streets, what would they do with them?—I have ordered them to bury them, and not throw them into the river.

2286. Do you ever have them buried?—I do.

2287. Have you enjoyed tolerably good health yourself during your inspections?—I never had a day's illness.

2288. Have your men also had good health?—They are generally in good health.

2289. When complaints have been made of those foul ashpits, have any of your men suffered from the smell?—Never.

2290. I suppose sometimes those places do smell very badly?—They do.

2291. And cause a great nuisance in the neighbourhood?—Yes, while the cleansing is going on.

2292. Do you think any arrangement could be made by which that kind of refuse should be prevented from accumulating?—Yes.

2293. Could it not be arranged, for example, that the accumulations should be removed at shorter intervals, so as to be prevented altogether?—Yes.

2294. Have you seen any of the common soil-pans that are used by cottagers?—No, I have not.

2295. (*Mr. Harrison.*) What becomes of dirt from pigstyes in case of heavy rains?—It generally drains off, but some cottagers who keep pigs will make a sumphole and put down a tub to catch the refuse, in order to sell it to manufacturers for scouring purposes.

2296. Is a good deal of pig manure collected for manufacturing purposes?—Yes.

2297. Do they collect urine from the inhabitants as well to cleanse cloth?—Yes.

2298. Is that very generally done?—Yes.

2299. What price do they pay for urine?—They go round with a kit, and give, I think, a penny or a penny halfpenny a kit-full or tubfull—a bucket or handcan-full, holding two or three gallons.

2300. How do they convey it from the houses?—They have large barrels.

2301. Is it a great nuisance when it is carried about?—I should think not. The smell might be offensive, but I do not think it is injurious.

2302. How is slaughtering carried on in Dewsbury?—There are private slaughtering-houses.

2303. What becomes of the refuse?—They collect it into tubs, and take it away to farms, and use it for manure.

2304. Is no part of it washed into the river?—Not much of it; there might be a little blood go when they wash the slaughter-house floors.

2305. Are they generally kept pretty clean?—The principal part of them are kept very clean.

2306. Refuse from pigs, urine from inhabitants, and refuse from slaughter-houses, are all kept from going into the river, and utilized, either for manufacturing purposes, or put upon the land?—Yes.

2307. Do you exercise your functions at all upon the banks of the river?—If I saw any person throwing anything into the river, I should threaten to summon them.

2308. Such as what?—Like dead fish. I have seen that done sometimes, and if I saw them attempt to do it, I should threaten to summon them before the magistrates.

2309. (*Chairman.*) In performing the duties of inspector of nuisances, do you regularly inspect the slaughter-houses?—Yes.

2310. You inspect those within the borough?—Yes.

2311. Do you recollect how many there are?—About a dozen.

The witness withdrew.

Mr. James Weatherhill (of Batley) examined.

2312. (*Chairman.*) Are you surveyor and inspector of nuisances at Batley?—I used to be; I am not now.

2313. For how many years were you surveyor?—For eight years, very nearly.

2314. How many years were you inspector of nuisances?—Five.

2315. Is Batley sewered?—Partly.

2316. Where are the outlets?—Into the beck, partly.

2317. How many of them are there?—A great number.

2318. Have you any idea how many there are?—No.

2319. Do you mean that each of the streets that runs down that way has an outlet?—No, not all of them; there might be half a score or more.

2320. As many as 10 outlets?—Yes.

2321. Has there been any complaint by manufacturers below, of the outlets going into the beck?—No.

2322. What passes out from them besides sewage; do any mills send their dye water into the sewers?—In one instance.

2323. At one end of the town?—No, in the centre.

2324. Are the sewers ventilated?—Yes.

2325. In what way?—By the fall pipes from the house eaves being connected with the drains.

2326. Have you any independent means of ventilation?—No; only shafts covered over with stones, so that we can get down to them for the purpose of repairing and cleansing.

2327. Are many of the houses drained?—Where we have cut new drains.

2328. Have many of the cottages waterclosets, or have they all ashpits and privies?—They have the latter.

2329. Do you cleanse those ashpits and privies, or are the people allowed to cleanse them?—They are cleansed by the occupiers when they are full.

2330. Have they a difficulty in getting farmers to take the refuse away?—Yes.

2331. When farmers are busy with their harvest and during seed time?—Yes; then they have to give money to get it taken away.

2332. How much do they pay to a farmer to take away a two-horse load?—1*s.*

2333. Then he would take his own time, I suppose, about it?—Yes.

2334. During the time the ashpit is being emptied, is it a nuisance to the district?—Yes, it is a nuisance.

2335. In any cases is it necessary to carry or wheel the refuse through the lobby of the house, or through the house?—There is only one instance that I know of like that.

2336. Have public-houses these ashpits and middens?—They have.

2337. Do you find them very foul when they are emptied?—Yes; the same as others.

2338. Are they not rather fouler than some others?—Yes, because they are more used.

2339. Is there much pig keeping by cottagers in the town, and if so, where does the refuse go to?—The cottagers have a tank made to receive that, and they sell it for scouring purposes.

2340. Is urine from cottages sold also for scouring purposes?—Yes.

2341. How much do the people get for it?—1½*d.* or 2*d.* a kit full for a strike or half a bushel.

2342. How many gallons is that?—Perhaps six or eight gallons.

2343. Is that supposed to be pure urine, without water?—Yes.

2344. Do they ever keep it till it becomes a nuisance?—They have not an opportunity of keeping it so long; carts go round and collect it.

2345. Is it kept inside or outside of the houses?—Outside, in a tub. Millowners furnish the cottagers with tubs, and they deposit it in them.

2346. How much will a cottager make in a year out of that kind of refuse?—I do not know.

(*Mr. Jubb.*) Perhaps 5*s.* a year.

2347. (*To the witness.*) How many scavengers have you employed under you?—I have about 53 men employed altogether.

2348. Masons, paviors, excavators, scavengers, and stone getters?—Yes.

2349. How many horses and carts have you?—About four or five; sometimes six.

2350. Do you ever tip road scrapings into the beck or into the river?—We have never done so yet.

2351. Do any manufacturers tip foundation materials in?—Not that I have seen.

2352. Have you any difficulty in getting rid of foundation materials or road scrapings?—Sometimes I have found very great difficulty in getting rid of them. I have had to pay 4*d.* per load to deposit them.

2353. How do you get rid of them now?—They are used for tillage partly on the land. We cart them to where they want them, where they are filling up for building.

2354. Do any manufacturers put their ashes into the beck, or so that the rain will wash them down into the beck in times of flood?—Yes, they do.

2355. You cannot interfere with it?—Yes, I should think we had power to do so.

2356. Have you ever interfered with it?—Never.

2357. (*Mr. Harrison.*) As inspector of nuisances, is your attention drawn to refuse thrown into the beck?—Yes, on several occasions, but I have not interfered.

2358. In going about the town have you observed the different kinds of refuse that are thrown into the beck?—I have.

2359. Do you know Mr. Jubb's shoddy mill?—Yes.

2360. Have you heard what he has stated, that there is no refuse thrown in from his mill?—I have.

2361. Can you corroborate what he has stated, that there is none?—Yes, except a little dust that comes from the flue, but which is very small.

2362. How far round the country do manufacturers send those carts for the urine; all round the neighbourhood?—They go into other townships to fetch it; to mills in Batley.

The witness withdrew.

John Jubb, Esq. (of Batley), examined.

2363. (*Chairman.*) You are chairman of the Batley local board of health?—Yes.

2364. Is Batley a township adjoining to Dewsbury?—It is.

2365. Is it a corporate town?—No.

2366. How long has the Local Government Act been in force in Batley?—The Public Health Act was in force in the first instance. The local board of health was instituted 14 years since.

2367. How long have you been chairman of the board?—I was chairman for the first three years, but I have only occupied the chair this last time since last March.

2368. What is the population of Batley?—At the last census it was 14,000; it has just doubled in 20 years; in 1841 it was about 7,000, and in 1861 it was 14,000; we estimate it now at 18,000.

2369. Are there many manufactories in Batley?—Yes, a great number.

2370. What is the chief trade carried on?—The heavy woollen trade, such as pilot cloths and blankets.

2371. Is it necessary to use water for those manufacturing purposes?—Yes.

2372. In what business are you engaged?—I am engaged in the rag-wool trade for manufactures. I have been a manufacturer of cloth myself, but I gave it up some years ago, and I now follow the business of importing and manufacturing rag-wool—wool that is made from woollen rags, and is imported from Denmark, Germany, and Austria.

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2373. Is that what is called shoddy ?—Yes.

2374. (*Mr. Harrison.*) What is the distinction between shoddy and mungo ?—Shoddy is pulled up from stockings, flannels, and guernseys. Mungo is made from fine cloth, such as you and I have on our backs now.

2375. (*Chairman.*) Have complaints ever been made of disease being introduced by the bales of old goods which have been brought into the country?—No, and it is wonderful to think that it is so free as it is. We have never had among the rag sorters and grinders any particular disease all the time that I have been engaged in the trade, and I have been in it now between 30 and 40 years.

2376. The materials have been in contact with all sorts of people ?—They come from all parts of the world—Egypt and different parts of Italy, and from Australia as well.

2377. In breaking up the bales, opening out the materials, teazing and dressing them to your knowledge no form of disease has been occasioned? —I never knew of such a case in my life, nor ever heard talk of one. We have had rags from Poland, Austria, Naples, and other places.

2378. How long have you known the river Calder, and the streams about here ?—Nearly 50 years, indeed all my life.

2379. What is their condition now as compared with what it was when you first knew them ?—Very different, they are very much worse.

2380. Are the rivers and streams more polluted ?—Yes, I used to fish in the streams up here when I was a boy. I have also fished in the Calder.

2381. What kind of refuse is usually poured out into the river by manufacturers ?—Solids ; and I am sorry to say that some put their ashes into the beck from the furnace. There is also refuse from dye wares.

2382. You mean spent logwood ?—Yes, after the virtue has been extracted from it, manufacturers to get rid of it, throw it into the streams. Then there are the suds, as they are called ; but they are not so bad as they were formerly. Manufacturers now obtain nearly all the solid matter for the purpose of making it into oil and soap again.

2383. They have begun to reconvert the suds here ? —Yes, at nearly every mill.

2384. Are there any mills at which it is not done ? —I do not know one. Where they manufacture cloth they use soap, but at my place we do not use it, and therefore we have no process to perform.

2385. The river is polluted above and below you ? —Yes.

2386. It is generally polluted ?—Yes.

2387. At the present time there are no local regulations by which the pollution may be prevented ?— No, there are not. We are putting down new sewers in Batley, and improving the place by flagging and paving very much.

2388. All the sewage of Batley, I assume, goes into the river ?—Yes, it goes into the beck and into the river. We have no outlet for it, nor any receptacle.

2389. I suppose you have not visited any places where sewage is applied to land ?—I was at Cockermouth in August last, and saw some sewage works outside the town, including the receptacle for sewage. I believe that the works were very new, and had not got into full operation. I am convinced that the application of sewage to land is possible to be done, if there is convenience for it. We are short of land here, and our mills are pressed for space, or else if they could find conveniences to put sewage irrigation into operation I have no doubt that it would be feasible.

2390. Do you know of any mills on the streams where they have either voluntarily adopted, or have been compelled by law to adopt, means to prevent all their refuse going into the river ?—I do not know of any case where the attempt has been made.

2391. Do you know of any cases in which lawsuits have been commenced by persons occupying manufactories below against persons above them ?—Yes, I do. I know that our vicar has had a lawsuit with a party on that very point.

2392. On what ground was the proceeding taken ?— It was for turning in sediment or suds which polluted the stream.

2393. How did it end ?—The vicar gained his cause.

2394. Did the pollution of the river cease ?—I think it did.

2395. How did the parties manage then ?—They bought all the land between the beck and their mill, and they then put this stuff into the beck at a point below the vicar's land.

2396. Some person is wanted below to enter an action against them again ?—The mischief was a very little matter, but it was sufficient to injure the vicar.

2397. Does not this instance show that there is in the common law of England power to prevent pollution if you can only induce persons to incur the expense of putting it in force ?—It would seem so.

2398. What is the rateable value of the property in your township ?—About 42,000*l.*

2399. What amount of debt have you incurred for sanitary purposes ?—All the debt that we have incurred is on account of waterworks.

2400. (*Mr. Harrison.*) What is the name of the Batley Beck ?—It has no particular name, it is called the Beck.

2401. Are there many manufactories all the way up it ?—Yes, every 200 yards.

2402. Does the river provide you with water not merely for household purposes but for manufacturing purposes ?—We have been short every year but this year for both purposes ; this is an exceptional year.

2403. The reservoir supply is both for domestic and for manufacturing purposes ?—For domestic purposes first, and then for manufacturing purposes.

2404. In the preparation of the shoddy have you to deal with much dust and dirt ?—Yes.

2405. What becomes of that ?—It is all collected to go on to the land for manure.

2406. It is not put into streams ?—No, it is too valuable for that.

2407. (*Chairman.*) Do you know whether it was put in at first ?—I think it was not.

2408. Is the dust blown out ?—Yes ; in the first place the dust goes under the ground through flues. I have a chimney outside to cause a draught to draw it from the machines, we empty about once a week all those receptacles.

2409. In manufacturing shoddy does any refuse go into the beck ?—None whatever.

2410. There is no pollution at all from your shoddy mill ?—None whatever.

2411. What class of manufactures do you think liable to pollute the rivers and becks the most ?— Dyers are as bad as any, because there are chemicals used in those establishments ; they use a deal of copperas to fix the colours.

2412. (*Mr. Harrison.*) May we take it for granted that in the manufacture of shoddy there is no occasion to pollute the rivers ?—I cannot see that there is.

2413. What should you say river pollution is caused by most ?—There is sewage from the town for which there is no other outlet, and which is a serious thing ; nobody has attempted to prevent people from putting into the river anything they choose, such as dead dogs, dead cats, &c. I think it would be well if somebody was appointed to look after those things.

2414. If your shoddy can be usefully applied to the land, do you not think that sewage might be properly applied and be quite as useful ?—Yes, I think so.

2415. What is shoddy supposed to be good for ?— The oily matters contained in it are valuable.

2416. To what plants would you apply it, to any particular garden plants ?—No, it is not much used for them ; I daresay it might be used for celery ; it is of a very warm nature, and does not answer if

put in large quantities on to grass land, it makes the grass too wild.

2417. Is it principally used for dressing ploughed land for turnips?—Yes, and partly for grass and potatoes too.

2418. How many hundredweight of dust do you think you could obtain from a ton of shoddy?—I should get, I think, three hundredweight from a ton on the average. Then there is another article that is made from the rags, flock for bedding.

2419. (*Mr. Harrison.*) Do you make that as well as the shoddy?—Yes.

2420. Is that similar in character?—Yes.

2421. (*Chairman.*) Is flock made from old woollen garments?—Yes, many of the mills do nothing else than make it.

2422. (*Mr. Harrison.*) Do you blow the whole of the three hundredweight out of a ton of shoddy?—It goes out in the grinding.

2423. Shoddy is not so clean as to be in a fit state to send to the manufacturers, is it?—Yes.

2424. You do not wash it, do you?—No, we do not, but I know many parties who do.

2425. (*Chairman.*) Is it bleached as well?—No, it is merely dried.

2426. (*Mr. Harrison.*) Is it not subsequently washed before it is used for making cloth?—No, washing is an unnecessary process, and only adds to the expense of the article when made.

2427. (*Chairman.*) There are fine particles that fly off from the shoddy as dust?—Yes, it cannot be entirely freed; some people are at the pains to re-riddle the dust and thus save some particles.

2428. Which particles would be used for manufacture and the remainder goes away in dust so that none of the refuse from shoddy finds its way into the beck?—No.

2429. Do you know of any instance in Yorkshire where the refuse goes into the river?—No; but with draught in the chimney, if any dust goes up the chimney it might spread a little and reach the beck.

2430. You would not call that pollution?—No.

2431. (*Mr. Harrison.*) Can you give us any other information as to the pollution?—In the first place the town sewage all goes into the beck, and there is no other outlet or receptacle for it; secondly, the beck is polluted by refuse from the manufactories, such as oily and greasy matters, but less so than formerly, as a great portion of the solid matter is now, by a certain process, obtained for making into oil and soap again; thirdly, the beck has been, and I fear is still, obstructed by persons on the stream putting in ashes, dye wares, and other such refuse.

2432. There is no excuse for their doing that?—No, there is not. The trade is that of the manufacture of heavy woollen goods, such as pilot cloths, and there are about 50 mills so engaged in the township. There are no floods, except when there are very heavy showers, or long continued falls of rain. The supply of water is partly from the natural watershed, which is very much supplemented by pumping at the various mills, and also by the waterworks to some extent. The acreage in the township is from 1,900 to 2,000.

2433. The refuse of the shoddy is valuable, and you make a profit by it?—Yes.

2434. What is the worth of a ton of refuse from shoddy?—About 10*s.* a ton for land purposes. We send it to Kent, and we get twice that amount for it for hop growing. Not only the dust but the waste is sent to Kent.

2435. Does 1*l.* a ton include the carriage to Kent?—No, to the place of delivery here, viz., the railway station.

2436. (*Chairman.*) Is scouring with urine and pig's dung still considered better than any chemical preparation that could be used?—Both ingredients are used together, and answer very well. I believe scouring is a very healthy occupation, although the ingredients used have a strong smell.

2437. (*Mr. Harrison.*) Have you worked practically at the mills yourself?—Yes, at every process.

2438. Are machines generally used in this neighbourhood for cleansing the wool?—Wool scouring generally is done by machine. Not all is scoured. Some of it is scoured when it comes to hand, and some is mixed without being scoured.

2439. What materials are used in scouring wool?—Chiefly or exclusively soap.

2440. Do you know whether the suds are reclaimed in your neighbourhood?—They are.

2441. Are they entirely saved?—Yes.

2442. The whole of the water that is used in cleaning is saved?—Yes, it runs through certain sieves into bags, and is saved in that way.

2443. There is no occasion for any refuse from that process going into the river?—They take care to keep it out, because it is a very valuable commodity.

2444. It was stated at Wakefield that not more than half of the total quantity as yet is saved. Mr. Teall stated that?—Perhaps so.

2445. Have you been a dyer?—Not myself; but we had a dye-house when I was a manufacturer.

2446. Can you suggest any means of preventing the pollution of the river by refuse from dyeworks?—I do not know what is to be done. Even if manufactories had receptacles to run the refuse into, and then let the water run off so as to leave a sediment, I think the effluent water would still be impregnated with the dye, unless they could deodorize it and kill the chemical properties.

2447. In the subsequent process of scouring the wool they again use soap and urine?—Yes, that is after it is made into cloth.

2448. Do they now save the refuse from that and send it with the soapsuds?—Yes.

2449. Do you know sufficient of the manufacture to be able to say whether the whole of the refuse might be saved from that process as well as from the cleaning of the wool?—I believe they try to save it as much as possible. It is their interest to do so.

2450. The only pollution of the river that you cannot see your way to remedying, in the manufacture of cloth, is that which is occasioned by the dyeing?—Yes, I consider that to be the greatest difficulty.

2451. All other refuse you think ought to be kept out of the river?—Yes.

2452. (*Chairman.*) Do you know Bierley?—No, but I know it is near Bradford.

2453. Do you know Birkenshaw?—Yes.

2454. What manufactures are carried on there?—There is a large worsted mill belonging to Messrs. Akroyd, and one or two woollen mills.

2455. Is there any pollution that comes down from Birkenshaw?—I am not sure, but I cannot see how it could be otherwise.

2456. Do you know Great Gomersall?—Yes.

2457. Is there any manufacturing carried on there?—Yes, woollen and some worsted manufacturing.

2458. Does any pollution come down from there?—I think the Gomersall water will run this way, and it would be no doubt polluted to a certain extent.

2459. Then Burstall; do you know that?—Yes; that is, on the same stream between Gomersall and Batley, and there are woollen manufactures there.

2460. There will be some pollution from that part?—Yes, our beck finds its rise at Birkenshaw.

2461. Great Gomersall is on one side and Birkenshaw on the other?—Yes, all the refuse comes into this same beck.

2462. It comes through Batley and into the main stream below?—Yes.

2463. Heckmondwike is upon another stream, is it not?—Yes.

2464. The stream comes from Cleckheaton?—Yes.

2465. Are there any manufactories there?—Yes.

2466. And at Hunsworth?—Yes, there are manufactures the whole way up.

2467. Are there any at Liversege?—There are some there.

2468. Are all those places growing in population?—Yes.

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2469. Are manufactures also extending?—Yes, at all places except Gomersall; that is at a standstill.

2470. Supposing that the rivers, streams, and becks continue to be neglected, and that manufactures, population, and pollution extend as much during the next 20 years as they have in the last 20 years, what condition do you expect the streams and becks will then be in?—I should think they will be in a dreadful state.

2471. Do you think it is likely that the streams will be so polluted that the water will be rendered totally unfit for manufacturing purposes?—It is beyond a question that they must become so, unless we could have more water from the waterworks. We should have been at a dead lock long since but for the water that is pumped up at the mills from underground.

2472. It has been stated that manufacturers would rather have the river left in its present polluted condition than be interfered with. What is your opinion upon that point?—I daresay that some of them are as selfish as that, but such persons ought not to be noticed. All ought to be compelled to refrain from polluting the river.

2473. But you hope that whatever regulations are made will carry common sense with them?—Yes, they must be practicable.

2474. And what manufacturers can be reasonably expected to perform?—Yes.

2475. Supposing you heard manufacturers declare, with regard to this Commission, that there was no necessity for the inquiry we are conducting, what should you say?—I have already had that put to me, and I have told the parties that I thought there was a necessity, and that something should be done.

2476. (*Mr. Harrison.*) Do the county police come within your jurisdiction at all?—Yes.

2477. If any measures were carried out for the purpose of obliging manufacturers to keep their refuse out of rivers and becks, it would be necessary, I suppose, that some one should look after them to see that they did so, and it has been suggested that an inspector or sergeant of the county police would be the proper person to report. Do you think that that system would answer?—I think it would be preferable to employ a person independent of local influence, instead of employing a person in the place.

2478. You think that it would be necessary to do that?—Yes.

2479. And that the county police would be the proper parties to report upon the matter?—I think so. They would be the most independent of any local influence that might be brought to bear upon them.

2480. (*Chairman.*) Have you anything further to state?—Only that lately the town has been greatly improved in paving, flagging, and sewering.

2481. And you are going on improving it?—We are improving it at a very rapid rate.

The witness withdrew.

Mr. J. T. Marriott.

Mr. John Thomas Marriott (Batley) examined.

2482. (*Chairman.*) What are you?—A cotton merchant. I manufacture cotton warps.

2483. At Batley?—Yes.

2484. Are you a member of the local board of Batley?—I am.

2485. Are you acquainted with the condition of the river and becks near Batley?—Yes.

2486. How long have you known them?—Nearly all my life. I was apprenticed in Dewsbury.

2487. Are they much worse now than they were when you were a boy?—Very much.

2488. From what does the pollution generally arise?—Chiefly from dyeworks.

2489. Ashes?—I cannot say that the river suffers very materially at this part from ashes, it does so near Huddersfield very much. The river Holme comes down and enters the river Calder a little beyond Mirfield.

2490. And brings in all the refuse which it has collected?—Yes. The Calder runs down from Todmorden and Halifax.

2491. What pollution comes down from Todmorden?—There is not very much until near Brighouse.

2492. What refuse comes in there?—Refuse chiefly from the same causes as down below here, though not to the same extent. There is a large trade in cotton at Brighouse.

2493. Cotton is the manufacture at Todmorden, is it not?—Yes; the river is not very impure there. The water is most impure in the stream flowing from beyond Holmfirth down the Huddersfield valley, in fact the whole of the stream from Huddersfield towards Horbury is polluted from the same cause.

2494. Are new mills growing up in the district?—An immense number.

2495. At this very time?—Yes.

2496. And I suppose each will add its quota of pollution?—They have not all dye-houses attached to them. The greatest amount of nuisance in this district arises from dye-houses and from sewage.

2497. Town sewage?—Yes.

2498. Do mills also send their sewage in?—Yes; cut the treatment of fatty and oily matter from the manufacture is made a regular business of, and is collected.

2499. Waste soap refuse?—Yes.

2500. Have you also heard that materials blown out of shoddy are taken?—Yes; that is now a very valuable article of commerce.

2501. Have you formed any idea as what could be done to prevent the growing pollution so as not to injure trade?—Not with respect to dye matter, but I think it very desirable that a system of economising the solid refuse of sewage should be carried out.

2502. Have you any idea as to how dye pollution is to be prevented?—Perhaps as Mr. Jubb said, it can be deodorized by some process.

2503. Sewage can be prevented from going in?—Yes. It is a matter of carelessness to allow dyewoods to go down the beck, because they might be used for fuel.

2504. You mean spent logwood and other materials?—Yes.

2505. If they collected it they could consume it under the boilers?—Yes.

2506. Do you know any one place where that is done?—Yes, several; for instance, at Old Craft at Batley, that is the instance which was mentioned by the surveyor.

2507. Refuse from the dyewoods is in some instances collected partially, and in other instances wholly, and you think that it may be collected entirely?—Yes.

2508. And that it may be got rid of without any serious cost to the parties themselves?—Yes. If consumed in the furnaces it would be an advantage.

2509. It can be mixed with small coal?—Yes.

2510. Do you know any dyeworks where an attempt has been made to take foul matter out of dye water before that water is passed into the river?—No; I remember an action between persons living beyond Bradford, and the arbitrators compelled the manufacturer to put in as much pure water as he had extracted from the stream; that is to say, to put in water from his own bore holes upon the premises.

2511. Is it the case that a great many of the manufacturers who establish new mills either sink wells, or put down bore holes to get pure water for their purposes?—I should think the whole of them.

2512. If they fail to get pure water so, what must they do?—They must resort either to the town's water or to the beck.

2513. They have to buy the town's water?—Yes.

2514. Do you know what it is sold at per thousand gallons ?—Sixpence.

2515. It is sold by meter ?—Yes.

2516. Then it becomes a very considerable item of charge to manufacturers ?—It is not considered dear to them. For scouring purposes it causes a saving in soap.

2517. Do you know whether the trade has been driven to other places where the water is more pure ?—Not since the waterworks were begun in this district, previously to that it was.

2518. What materials were affected before that ?—The heavy woollen trade where bright water was required for scouring, that branch of the trade went to Mirfield.

2519. Do you know the Galashiels trade ?—Yes.

2520. Of what character is it?—Scotch tartans and woollen shawls chiefly.

2521. Has any part of the Yorkshire trade been driven away to Galashiels ?—I do not know.

2522. Supposing that this extension of pollution goes on, and that nothing is done to prevent it, in what sort of condition will the river be in the next 10 or 15 years ?—We shall be in an infinitely worse position ; I believe that the pollution of the streams from manufactures will go on in the district until it will be absolutely necessary to adopt some process for the preservation of health.

2523. Existing streams might almost be destroyed for any useful purpose ?—Yes.

2524. Certainly for any purpose of washing ?—Yes ; the river is made too much a receptacle of all kinds of mischief.

2525. You see the mischief which is likely to arise if pollution is continued ?—Yes. When I was a boy I used to be a frequent bather in the river Calder ; it is now so dirty that it is out of all question to bathe there, and it is also too polluted for fish to live in it.

2526. Have you ever seen any place where sewage is applied to land for agricultural purposes ?—Yes.

2527. Where?—Down below Leeds, at Mr. Leather's the engineer's.

2528. What sewage does he apply ?—The Leeds town sewage.

2529. Does he do it with any advantage ?—I am not aware.

2530. Are you aware that the town sewage of Leeds now goes into the river?—Yes; but Mr. Leather the engineer I believe had some conveyed upon his land. He has some meadow land adjacent to the river some four or five miles below Leeds.

2531. Has he given it up ?—I believe that he has ; but in my opinion irrigation of town sewage may be carried on with very great advantage both to farmers and also to towns.

2532. If properly conducted ?—Yes.

2533. In the event of regulations being devised for preventing pollution, what body do you think should carry them out; would you trust manufacturers to regulate their own affairs, or would you have some superintendence placed over the river which should be independent of the manufacturers ?—Manufacturers show a very great disposition to abate the pollution as far as practicable, but nevertheless I think that an impartial tribune would be as well.

2534. But you think that there is now that sort of good sense and good feeling amongst manufacturers that they would go a long way in carrying out such regulations if they were made to aid one another ?—Yes.

2535. If no absurd regulations which destroyed profits of trade were established, you would expect to find that they would not resist the regulations?—Certainly. Our Board of Health is composed in a great measure of manufacturers, and there is a very great disposition on their part to abate nuisances from sewage and everything else.

2536. And to aid each other to improve the condition of things ?—Yes.

2537. And I suppose that they are very anxious to have information as to what can and may be done ?—Yes.

2538. (*Professor Way.*) You have said that it is quite easy to burn the solid matter of the dyes ?—Yes.

2539. It might be piled up and left to dry till it was wanted to be put in the furnace to be burnt ?—Yes ; putting it into the river is a matter of carelessness.

2540. The goods do not take the whole of the colour in the vats ?—No.

2541. What is to be done with the remainder ?—It is for you professional gentlemen to say what is to be done with it ; that is a chemical process.

2542. Do you know of anything having been tried to decolorize this refuse water ?—No.

2543) It is to the waste indigo and logwood, and so on, that the colour of the water is due ?—Yes. I believe that the coloured matter might be got rid of by filtration.

2544. Is it separated by filtration ?—Filtration would in a great measure separate the colour from the liquid, but would not take away the deleterious matter.

2545. If the colour could be removed from, say, the spent logwood vats, would anything very serious be left to injure the river ?—Yes ; just the same chemical matters would be in, acids, and alum, and so on.

2546. And some portion of tin ?—Whatever mineral matter was in before filtration would be in afterwards.

2547. Do you think that that refuse water could be dealt with ; could it be put upon the land at all ?—I think that it would be injurious, and would burn the land up.

2548. What is the quantity of liquid discharged from the dye vats in a manufactory of considerable size ?—Very large, with the process of dyeing and the process of washing.

2549. Is it large from the dye vats themselves ?—Yes, very large.

2550. To boil it down would not be practicable ; would be far too much for you ?—Yes.

2551. You think that the water of these rivers is fast coming into a condition in which manufacturers will not be able to use it except for steam power ?—I do.

2552. They will therefore be entirely dependent for their supplies upon the town supply and wells, and so on ?—Yes.

2553. Is the well water equally good for the purposes of the dyer and the manufacturer ?—No, it varies very much, according to the different minerals in the various districts.

2554. Is the water supply of the district generally softer than the well water ?—Yes.

2555. And more fitted for the manufacturer ?—Yes.

2556. Therefore the manufacturer injures himself by injuring the water ?—Yes, to a certain extent.

2557. (*Mr. Harrison.*) Have you any refuse from your manufacture ?—None at all.

2558. You do not turn any refuse into the water ?—No ; I merely double the yarn after it is spun for the purpose of making warps for woollen material.

2559. Do you corroborate the evidence which has been given by Mr. Jubb as to there being no refuse sent from his manufactory ?—There is nothing but what it is positively impossible to prevent ; a little dust which may fly off from his mill, that is all.

2560. You consider that his evidence is a complete answer to the question as to the manufacture of mungo and so on ?—Yes. I also corroborate his evidence with respect to no known disease having been imported into this country through rags ; that point has been frequently dwelt upon. There are persons in this district who have had large experience.

The witness withdrew.

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Mr. M. Ridgway.

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Mr. Matthew Ridgway (Dewsbury) examined.

2561. (*Chairman.*) In what business are you?—I am a draper in Dewsbury.

2562. Are you a member of the Dewsbury town council?—I am.

2563. How long have you known this district?—Close on to 30 years.

2564. Then you have seen a considerable growth of the local trade?—A great deal.

2565. It has grown up very rapidly?—Yes.

2566. How long has Dewsbury had a town council?—Four or five years.

2567. Have you noticed the condition of the river during the period that you have resided here?—It is in a very much worse state than when I first knew it.

2568. More polluted?—Yes, much more polluted.

2569. By the growth of manufactures?—Yes, and increased population.

2570. If it is left as it has been previously will that pollution become greater?—Pollution must increase.

2571. What trade is liable to defile rivers and streams the most?—The principal fact which I wish to speak to is one which came under my notice during last summer; the town was covering up an open beck, which is in fact the main sewer of the town and during the process of covering up the stream had to be diverted, and after a thunder shower, when the water subsided, a fact exhibited itself to me which I had never noticed so materially before; I refer to a very heavy deposit of dye wares. I should think that there must have been hundreds of loads of dye wares which were stopped from not having a free course, evidently showing that dye wares were disposed of in a very summary manner during the storm by putting them into the stream and getting rid of them.

2572. What do you mean by dye wares?—Spent woods from the several dyes.

2573. Did you hear the evidence of the last witness as to the possibility of utilizing or consuming that mass of refuse?—I did.

2574. If the fluid was allowed to flow off might the spent woods be consumed under the boilers?—Yes, I heard him state that.

2575. Do you think that to compel them to do so would be a very proper regulation to make?—I am not prepared to say how the dye wares should be disposed of, but I think that under no circumstances should solid dye wares be put into the river. I think that they might be carted away and disposed of in some other way without any injury to the manufacturers.

2576. Do you know of any complaints having been made as to injurious effects after these dye wares have been washed down?—No.

2577. You are aware, I suppose, that water power is very much sought after, and also water for dyeing?—Yes.

2578. Have you taken any interest in the question of the water supply?—I have.

2579. Do you find a pretty good demand for your water for manufacturing purposes?—Not quite so much in this town as they have in the neighbourhood of Batley. We have the river to fall back upon, which they have not.

2580. Some manufacturers get a portion of their water from the river?—Yes.

2581. They also pump it from wells?—Yes.

2582. (*Professor Way.*) Is there any means of forming a notion of the quantity of dye wares consumed in the district?—I think that it might be pretty easily obtained from the parties who supply the dye wares for the district.

2583. Do you think that a large quantity of dye wares is thrown into the river, or is that merely an exceptional method of getting rid of them?—It must be a very common way of getting rid of them, or so much would not have been there in one flood that came down a tributary.

2584. Then it would not have come down from many mills?—We have a number of mills on those streams. In fact the water is very nearly as bad as it can be on the beck which runs through Batley and Dewsbury.

The witness withdrew.

Mr. E. Auty.

Mr. Edwin Auty (Mirfield) examined.

2585. (*Chairman.*) What are you?—Cashier and book-keeper to Messrs. James Howgate and Sons.

2586. What do they manufacture?—Woollen goods.

2587. Are they manufacturers on a large scale?—Yes.

2588. Where are their works situated?—In Ravensthorpe, Mirfield, about a mile and a half from here.

2589. How many hands are employed in that mill?—Between 300 and 400.

2590. What is the business carried on?—One branch o it is dyeing.

2591. What is the other branch?—Spinning, weaving, and finishing; in fact, all the processes of woollen manufacture.

2592. Where do Messrs. Howgate obtain water from for their dyeing and manufacturing purposes?—From the river Calder.

2593. Do they obtain any from the waterworks?—No, we have not the water from the waterworks in the place.

2594. Have you pumps or wells on the premises?—We have no pumps connected with the works at all. We pump direct from the river for all purposes.

2595. Where do you send the waste dye water?—Down a sewer which we have on the canal side.

2596. And where does it find its way to?—All the mills are connected with a main sewer on the river side, by the towing-path.

2597. Where is the outlet of the main sewer?—Just beyond the mills.

2598. In the river?—In the river.

2599. Then all the waste water goes down that sewer?—Yes.

2600. And flows into the river?—It does.

2601. Do you take out the spent dyewoods from the dye water before it goes into the sewer?—Yes, and all other refuse which it is possible to take out.

2602. What do you do with the spent dyewoods?—We take them into the firing-place, and use them with the coal for firing.

2603. How long have you known the river?—Above 30 years.

2604. Is it as clean now as it was when you first knew it?—No, that is impossible.

2605. It is much dirtier?—Certainly it must be.

2606. Do your people ever complain of the dirt in the water being injurious to their manufactures?—It does not affect us, because we are now the highest up, except one, of the mills in that valley.

2607. At the mill above you, do they dye?—They have just commenced.

2608. And are they sending their foul water down upon you?—Certainly the foul water must come down the river; they have no other outlet.

2609. Are many new works being established in the district?—They are all new works in that valley now.

2610. Then we cannot tell what amount of pollution there may be if they go on building new works?—It certainly will get worse if more mills are built.

2611. Does the sewage from the privies and closets of the mill go into the river, or beck, or main sewer?—We have them emptied.

2612. You have them arranged so that you can empty them and cart away the material?—Yes, with the exception of one little one.

2613. How long is it since the new mill above you

began work?—It has been about 12 months in operation.

2614. Do you know whether your people objected at all to the water being taken above them?—They could not object.

2615. Because I suppose the land was let or sold by the owner?—Yes.

2616. Supposing that the proprietors were to sell land for 20 or 50 mills, I suppose that your firm must take the chances?—There is not room for that number now.

2617. At all events the owners of the present mills would have no power to interfere with any other mills being started?—Not under present circumstances.

2618. They would have to buy the land if they wished to prevent it?—Certainly they would.

2619. (*Mr. Harrison.*) Are you well acquainted with the different processes carried on in your mill?—Yes.

2620. You have heard the evidence that the sud-water from the cleansing of the wool and the cloth is generally collected throughout the district, is that so in your mill?—We have a yearly rent from Messrs. Teall, Lepaige, and Co., who take the sud-water, and it is all collected by them and none of it goes into the river.

2621. Do you collect the whole of the water which is used in cleaning the wool and the cloth?—Yes, the whole of it.

2622. None at all is passed into the river?—None at all.

2623. What do you do with the water which comes from the dye processes?—We let it go down the common sewer belonging to all the mills.

2624. Can you suggest any means of preventing the pollution which is caused by that liquid?—I should myself say that that is impossible.

2625. Have steps been taken at any time with the view of diminishing the pollutions from that source?—Formerly we used to let all the dye wares flow down the river; we saw that it would be a nuisance; solid matter accumulated at the end of the sewer.

2626. That is the spent wood?—Yes. And then it was agreed by the masters of all the mills to have perforated zinc plates put into the vats and the pans, so that no wood could get down, and now nothing but water goes down.

2627. (*Professor Way.*) That, I suppose, would stop all the coarse particles of wood?—Yes.

2628. One witness said that merely allowing these liquids to rest would get rid of a great deal of the colour?—I should think that he is not practically acquainted with the subject, or he would not have said so; many thousand gallons are disposed of in a day. The colouring properties are contained in the chemicals, and you cannot separate them except by some chemical process.

2629. If you took a vat of this dye after you had separated the gross particles of the wood by the perforated zinc, and let it rest in a hogshead, would the upper part of the liquid be clear like water?—It would be transparent but not colourless.

2630. And you do not think that any ordinary process of filtration would separate it?—No, that is impossible; and anyone who is practically acquainted with the subject will tell you the same.

2631. Do you think that the establishment of the mill above your mill will do you any harm?—It will not seriously affect us.

2632. The water will not be sufficiently injured to affect you?—No, it will make a little difference but not much.

2633. Still you would rather that the mill was not there?—Certainly.

2634. Every additional mill on the river, or every additional amount of work done by existing mills, is an increase in the pollution of the river, objectionable not only to townspeople, but to mill owners themselves?—Every dye house.

2635. I suppose that it is possible to conceive the time when the mills will be in such number and extent that you will not be able to use the water at all in the lower mills?—No, I should say that that is not likely to be yet, not in our day.

2636. Not for washing purposes?—Another witness probably will be able to speak to the river lower down than I can.

2637. Is it not the case that the mills lower down the river will be gradually obliged to discontinue the use of the river water for all purposes except for boilers?—I should say that it would be a long time before that would be the case along the banks of the Calder up in Mirfield; it is in the low part of Mirfield that our works are.

2638. It is a question of degree?—Yes.

2639. (*Chairman.*) How far are you from the Calder?—The mill goes up to its bank.

2640. You are upon the bank of the Calder?—Yes.

2641. Then you are in a position much more advantageous than many of the people who are upon the small streams altogether?—Yes.

2642. (*Professor Way.*) Are you not upon a tributary which runs into the Calder as well—the Beck?—No.

2643. (*Mr. Harrison.*) Are there not mills higher up the river than you, namely, at Sowerby Bridge, which have the refuse from Halifax?—Yes; there are a good many dye houses up above, upon the banks of the Calder, but when the water comes down to us it is a good deal settled.

2644. Is not that against the evidence which you gave us just now, that there is no probability of separating the colour from the water by settling?—You asked me whether it was possible for a quantity of dye stuff in a pan to settle by standing, and I say no, but if you dilute it the colour is less, that is my answer.

2645. (*Chairman.*) You think that it loses its colour by dilution and not by precipitation?—That, I believe, is it.

2646. (*Professor Way.*) Or possibly by meeting other kinds of chemicals in the river?—Certainly.

2647. You have said that formerly all the spent dye-woods were thrown into the river, but that you now keep out of the river all other refuse which it is possible to keep out?—Yes.

2648. What other refuse do you refer to?—In cotton dyes principally sumach, that is in a ground state.

2649. (*Chairman.*) Like sawdust?—Yes.

2650. (*Professor Way.*) Is there any other refuse but that?—No.

2651. What colours do you dye?—Principally blacks; what we term logwood blues and browns, those are the principal colours which are dyed along the banks of the stream.

2652. Scarlets?—No, we have not much call for scarlets.

2653. Do you ever dye scarlets?—Yes, when we want to do so, but it is very seldom.

2654. Is the water of the Calder which you get at your place fit for dyeing scarlets?—Yes.

2655. Can you dye as clear a scarlet as other people situated higher up the river?—Yes, we can dye what suits us very well.

2656. You say that blacks, and logwood blues and browns, are the principal colours?—Yes.

2657. What materials do you use for those colours?—Logwood is the principal material for dyeing those things.

2658. With browns as well as with blues and blacks?—Yes; logwood and the other matter which is connected with it chemically forms the colours.

2659. That is the mordant?—Yes; iron mordant is used with the cotton after the wool is dyed.

2660. Do you use tin at all?—Yes, some solutions of tin, we are obliged to do so.

2661. And bichromate of potash?—Yes.

2662. Is the consumption of these things in a manufactory very large?—No, not so large as some people would imagine.

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Mr. E. Auty.

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2663. May we take it that a great deal of the material which is used, iron chromate of potash and tin, finds its way eventually into the river?—A certain portion of it does, but the material absorbs a large proportion.

2664. The tin is used as a mordant?—Yes, it is what is called an iron mordant.

2665. You do not know that any attempt has been made to discolour the dye waters of the vats before they are thrown into the river?—No.

2666. You have no subsiding reservoirs of any sort?—No.

2667. Do you know of anybody who has?—No, not in our district.

2668. (*Chairman.*) Do you know of any in any other district?—I cannot say that I do.

2669. If you had better water do you think that your dyeing trade would be extended, that you could dye better or more delicate colours?—I do not know that; we dye drabs, lavenders, and scarlets, and all that is required.

2670. Have you ever heard that because the water was not pure enough, part of the manufacture of finer goods had been driven away from Yorkshire into Scotland, to Galashiels, and other places?—I cannot say for that myself.

2671. You do not know of that?—I do not.

2672. And so far as your experience goes your water is good enough for you?—Yes.

2673. Your people would be content to remain as they are?—As for that I expect that we should be obliged to be content.

2674. I mean that you are not suffering from pollution so much as some people are?—We are not.

2675. Do you know the manufacturers who are suffering more from it than you are?—I cannot say as to any further down the stream. In our district the water, considering all things, is very fair; the river there is very broad.

The witness withdrew.

Mr. Robert H. Ellis (Mayor of Dewsbury) examined.

Mr. R. H. Ellis.

2676. (*Chairman.*) You are mayor of Dewsbury?—I am.

2677. Are you engaged in any business?—Yes, I am a woollen cloth manufacturer, a partner in the firm of Joshua Ellis and Sons.

2678. Is your mill situated in this district?—Yes, we have one mill on what is called the Batley Carr Beck, and we have another in which we dye and carry on the milling process on the river Calder.

2679. About what number of hands do you employ in each mill?—I should say that we employ nearly 500 people with the women.

2680. How long have the mills been established?—The Batley Carr Mill was the second mill built in the village, it was, I think, built somewhere about the year 1820; my father built it.

2681. Is clean water an advantage for the manufacturing processes which are carried on in your mills?—Decidedly.

2682. How long do you recollect the river?—Since the year 1834.

2683. I scarcely need ask you whether the water is worse now than it was then?—It is getting worse every year. The fact is that the water in the Batley Carr Beck now is of no use whatever except for working the boilers, but for that process it is in my opinion almost the best water in Yorkshire; there are very few equal to it.

2684. It is so soft?—Yes.

2685. And the foul matter put into it simply discolours, but does not injure it?—Yes, the soap and other matters which are put in benefit the water so far as the boilers are concerned. Water put into boilers has a natural tendency to encrustation.

2686. Hard water?—Almost every water that I know has that tendency; I was speaking the other day to Sir Francis Crossley at his works about their water; it comes from a beck, and he showed me an incrustation upon their boilers half an inch thick.

2687. Does the water of Batley Carr Beck give an incrustation?—This beck gives no incrustation whatever, and that makes it extremely valuable for working boilers.

2688. For washing and dyeing purposes where do you get your water?—Some years ago, when my father was a young man, all the goods were washed in Batley Carr Beck, in fact he used to bathe there, but that process very shortly came to an end, and ever since I should think it has been of no use whatever except for working boilers.

2689. Have you any idea how many mills there are on the beck?—I have not counted them, and I could not tell without reflection.

2690. But there are a considerable number?—Yes, an immense number; I should think that there would be 40 at least.

2691. In what length of river or beck?—There would be above 40 taking from the entrance of the beck into the river Calder up to Birstal Church.

2692. Do the mills rise up as far as Birkenshaw?—I think that they do not take the water from the beck there because the proportions of it are so small; I should think they have some other source.

2693. There are mills at Birstal?—Yes.

2694. And all the way down?—Yes.

2695. And there is another branch to the beck to the right just below Batley?—Yes, there is a little branch there.

2696. Are there any mills upon it?—Yes.

2697. There is a place called Old Hall?—Yes, I know four mills on it.

2698. Then I suppose we may take it that mills have been erected where they could find ground and water?—Yes, almost everywhere on that beck.

2699. Railway and road accommodation have been afforded to them, and have increased the manufacturing advantages?—Yes; the difficulties of this water have been thought over many times in this town, and it was considered whether or not anything could be done to clear the beck, but the difficulties were so great that it was given up. If you took water out of the Batley Beck for manufacturing purposes, and only returned it in a clean state, you would very quickly entirely empty the beck.

2700. You mean if you could dispose of the foul water, so as not to let it flow back again into the beck?—Yes.

2701. But if the foul water could be comparatively purified and brought back to the river again, then of course the waste of water would not be very material?—The waste would not in that case be very material, but the remedy would be infinitely worse than the disease, because if you, as we did many years ago, put the soapsuds and all the dirty water into a reservoir in order to let it form a sediment, and then return the water in a clear state, the stench from the reservoir would be so great that no person could live in the district.

2702. I suppose that you utilize your soapsuds by the new process, namely, by taking the oil and grease out of them?—Yes.

2703. And the effluent water after that process goes into the river?—Yes, but still dirty.

2704. But not so dirty as when the whole soapsuds are in it?—Certainly not.

2705. Do you think that in the effluent water passing from Messrs. Teall's presses, the same process of corrupting fermentation would take place to the same extent as in the original soapy and dye water?—I believe that it would take place, but not to the same degree.

2706. But you never tried it?—No.

2707. Is there anything in logwood and the other dyewoods to corrupt and ferment?—Not that I am

aware of, but it would be a difficult matter to form an opinion of, unless all the dyewoods were put into one place so as to form a sediment.

2708. You think that an intercepting sewer or intercepting conduit to collect all the refuse and take it away would be worse than the disease?—Yes.

2709. You would very soon have the beck dry, and your mills without water?—Yes.

2710. And, therefore, foul as the water is, you must do your best with it?—Yes. If you put any large quantity of material into a reservoir to form a sediment, some stench must arise from it; there is a smell even from water if you let it remain stagnant for a great length of time, and that smell is unhealthy. A running stream is a healthy stream. Even our beck, because it runs so quickly as it does, I do not think is very unhealthy.

2711. But if made a stagnant pond of, you have no doubt about its being unhealthy?—I have not a doubt that it would form a nucleus of disease. The reservoirs which were constructed formerly made a dreadful stench, and in fact were injurious to health.

2712. Then the remedy for the pollution by dye water must be something different from forming large depositing or sediment tanks?—I feel satisfied of that.

2713. Do you know whether in any case the dye water has been used to irrigate grass land?—Not the liquid matter. In our own mill some years ago we put all the dye wares and everything which we could in a heap, but we were obliged to destroy it, because we found that they were extremely injurious to land; in fact they poisoned the land.

2714. Which of the dye wares?—The dye wares from our mill were logwood and fustic, and there would be some vitriol mixed with some of them, and alum, and copperas; we used almost every kind of dye ware.

2715. Was a trial made of the effect upon land?—Yes; an uncle of mine tried it, and a number of tenants whom I knew very well. I put it over a large extent of land here, and I gave it to the tenants, and they tried it, and they did not like it.

2716. Did it occur to you that it might be too strong, and that a dilution or mixture might have rendered it available?—Our dye wares were used just as they were. I did not interfere with them in any shape or form. I merely sent them away just as they were. If they had been diluted in something weaker I suppose that it would have been better.

2717. Have you ever used guano as a manure?—Yes, repeatedly.

2718. Could you kill plants by dosing them too heavily with guano?—Yes.

2719. Or with other manures?—Yes, with strong manures.

2720. So that it need not be taken for granted, without further experiment, that the dye wares are entirely unfitted for agricultural purposes?—No. The only case in which I found them in the least degree available was this: on a very thick clay subsoil the farmer ploughed the land deep and put a layer of this matter in the bottom, and then covered it over with soil, and he told me that he thought that it was beneficial.

2721. That was the solid material?—Yes.

2722. Have you utilized the refuse of your dye-wares in any way for furnace purposes, by drying and burning them?—We have burnt our wood.

2723. I suppose there is no difficulty in that process?—Not the slightest. There is really no difficulty with wood, and I think that wood ought to be kept out of the river, because wood is a solid element, and if used in large quantities will naturally stop up the river. There really is not the slightest necessity for the wood to go into the river.

2724. I suppose that in your dyeing processes the material which is extracted from the wood would be a very small percentage of the weight of the dye woods when brought in?—Yes.

2725. So that if you knew that percentage and the weight of the dyewoods when brought in, you would get a very close approximation to the weight of dry refuse?—I should think so.

2726. The refuse which was made would weigh as heavy or heavier than the dyewood originally?—I should think so. On the river Calder at our dye-house we can now dye any dark colour, and we do so regularly. We dye indigo blue, and logwood blues, and blacks, and browns, out of the Calder water. I may state that there are about eight mills all in a line, and we have formed a large sewer from the top through these mills, and each mill puts all its dirty water into this sewer, so that we get the river water as clear as it is after it leaves Huddersfield.

2727. That is a private arrangement amongst yourselves?—It is.

2728. Do you think that such an arrangement might be extended to other districts?—Yes. I am quite satisfied that there is an element in it which might be carried out in places where there are a great number of mills. The owners of mills might be compelled to put the refuse into a sewer, and to send it forward so that it would not injure the neighbours. Of course even that has an end.

2729. You have used the word "compelled." Speaking as a manufacturer, if any obstinate manufacturer would not combine with his neighbours for the general good, you think that there would be no hardship in a power being given to compel him to do so?—Not the slightest. I feel satisfied that the great body of manufacturers would agree to anything reasonable which was brought out for purifying any stream if it was effective and useful.

2730. In your experience have you ever found individuals inclined to be obstinate, and not to agree to reasonable propositions?—I never was in any large assembly where one or two of those people did not exist.

2731. Then you want a power which shall be imperative, and the majority must have the power of ruling the minority?—Yes; I certainly should agree to such an arrangement myself, and I think it would be a very useful thing. There is a very dirty beck turned in just below our manufactories, namely, the Heckmondwike beck. I do not think that it is quite so bad as the Batley one, but still it is very bad.

2732. Are you aware whether any delicate dyeing has been driven away from the district on account of the impurity of the water?—I do not think that it has been driven away from the district, but it has been driven into little curious places where they can get good water; for instance, there is a little dye house put up near Batley which takes the pure water just as it comes from the hills, and that is useful for dyeing certain colours. I heard the evidence which was given by Mr. Auty upon the question of dyeing. The light dyes in the goods he manufactures are not required to be so very pure and so very free from specks as in the dye-house which I have just referred to, where they dye pieces.

2733. (*Mr. Harrison.*) There is no doubt that for valuable scarlets the work must be taken to a pure stream?—There is no doubt of that; but we have this advantage in this neighbourhood, that we can dye the finest colours in the world from our town's water.

2734. (*Chairman.*) From your reservoir water?—Yes.

2735. That is a singularly pure water?—It is a singularly pure water, and as we get it at 6*d.* per thousand gallons, we can afford to use it.

2736. Have you any idea what the value of the river Calder would be at 6*d.* per thousand gallons?—Of that I am not aware.

2737. It would be of very enormous value?—Yes.

2738. You are content as dyers and manufacturers to pay for pure soft water 6*d.* per thousand gallons?—We are.

2739. You perhaps use 20,000 or 30,000 gallons or more in a week?—Yes.

2740. With your knowledge of the trade of the

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district, and the condition of the becks, do you think that it is necessary that some legislation should take place to compel manufacturers to correct the evils which have grown up?—I do think that some sort of supervision is required, but I have not yet seen anything like a solution of the question; the difficulties are so enormous, they vary according to the locality. What would be useful in one locality would not be useful in another. For instance, if you take our Batley Carr Beck, I do not see that you could improve it in any way except by keeping the solid dye wares and sewage out. I think that that might be done, and ought to be done, legislation which would effect that object would be useful.

2741. If you take many of the becks in this district, do not you find them abused from their sources down to their junction with the main stream, and does not every owner of a mill, or of an estate, tip foundation and everything that he likes into the beck or stream?—Yes.

2742. If there are mills where from 2,000 to 3,000 tons of coal are used every year, and where they never take a spadeful away, but let all the ashes go into the stream, do you think that that alone could be prevented?—Yes, and I certainly think that it ought to be prevented.

2743. If with regard to the dye water, practicable means could be shown by which the colouring matter could be thrown down—and when I say practicable, I mean practicable in a common-sense way—do you think that there would be any hardship in requiring that every man in the district should be compelled to adopt it?—I think that there would be no hardship if it involved only a reasonable expense, and if the purifying process was not liable to become a nuisance to neighbours living around.

2744. It would be anything but reasonable, or practical, or common sense, if it was that?—In the broad way in which you have put it, I should say that there would be no hardship in such a measure being made compulsory.

2745. Do you think that if you were left to yourselves, as you have been since the trade has grown up, you would be likely to enforce such regulations?—I think not.

2746. You would be going on from hand to mouth, and doing the best under difficulties?—Yes.

2747. If you individually as a manufacturer chose to spend 5000*l.* or 6000*l.* in experiments, and found out a means of purifying your own water at a cost to yourself of a few hundreds a year, do you not think that you would very soon drop into your old groove if no other person took up the subject?—Certainly. I think that legislation is decidedly advisable.

2748. Supposing it proved that it would require a certain amount of cost to render this water pure, then if every manufacturer in England were put under the same conditions, do you think that a compulsory measure would be a serious injury?—I do not.

2749. In that case no one would have an advantage over his neighbours, and the trade of the world would pay for the cost?—Certainly.

2750. If you cannot manufacture goods for one price, you must have a price for which you can manufacture them?—Yes.

2751. But now you cannot tax one individual with a percentage which no other person chooses to bear?—I think that legislation on the subject is very desirable, because I am satisfied that there are many things which can be improved. For instance, all solid matter ought to be kept out of rivers. Dye wares sometimes go into the rivers in such quantities that they make quite a large bed; there is no necessity for that, and it ought not to be allowed.

2752. And you are now speaking as a manufacturer producing that sort of refuse?—Yes; but if there is no legislation on the subject, nothing will be done. And the measure must be compulsory, if it is not to be as inoperative as the legislation against the smoke nuisance; you cannot get the law which has been passed to be of any avail whatever.

2753. You want an outside authority?—Yes.

2754. Which authority shall not be too centralizing, and shall not over-ride the local authorities in a rough shod way, but shall simply aid the local authorities?—Yes. I go on this principle, supposing it shown that you could purify the water at a reasonable expense, it would be a great boon to have a measure for purification carried out from a central and vigorous authority.

2754*a*. (*Mr. Harrison.*) Can you give us information as to the quantity of water which you use in the different processes of your manufacture in cleansing the wool, in dyeing the wool, and in cleansing your cloth?—I could not give you the quantity in the number of gallons, but we use water pumped through a pipe of about six inches diameter, which is always running when the engine works.

2755. (*Chairman.*) For what purpose do you use that water?—For cleansing.

2756. For how many hours a day do you use it?—We are using it all day.

2757. A pipe like that would give you about 150,000 gallons in 10 hours?—A little runs over the cistern occasionally, but not generally.

2758. (*Mr. Harrison.*) Can you state what quantity of wool it cleanses and dyes?—About 100 packs a week of wool and shoddy together.

2759. How many pounds are there to a pack?—240.

2760. This morning Mr. Jubb stated that he did not use any water at all in the manufacture of shoddy, but that it was cleaned merely by the process of blowing and depuration?—That is so in his process, but he is merely a manufacturer of shoddy.

2761. After he has made the shoddy does the cloth manufacturer find that it wants washing?—We do not wash a great quantity of shoddy which we use until it goes out in a woven state, but we sometimes dye shoddies, and then they want washing.

2762. All the refuse which comes from the cleaning, preparatory to dyeing, goes away in soap suds?—Yes.

2763. What quantity of that water do you think would be daily used in the dyeing process?—In the dyeing, and in the washing of the pieces after dyeing, we use a very large proportion of water, because, having a very large supply from the river Calder close at hand, we use it rather liberally; the more water we have the better cleansed is the material. I should say that we use fully three-fourths of the water for the dyeing and washing the wool and pieces after dyeing.

2764. You have said, as I understood you, that manufacturers of Dewsbury have constructed a culvert?—Not the manufacturers of Dewsbury. I was alluding to the mill of ours which is on the river Calder in a suburb of Dewsbury. A culvert has been constructed by eight manufacturers.

2765. And the effect of that is, to give as good water to the mills at the lower end of the culvert as to those at the upper end?—Yes.

2766. Over what length of the river is that?—I should think that those eight mills occupy about a quarter of a mile.

2767. (*Chairman.*) Not more?—It is a difficult point to answer, but I should say not more than a quarter of a mile.

2768. (*Mr. Harrison.*) What sized culvert is it?—It is rather better than three feet deep, and I believe that it is 18 inches wide.

2769. What is its shape?—It is egg shaped.

2770. To what height is it filled?—It varies according to the quantity of manufacturing going on; but taking a fair average, I should say that it is about half filled.

2771. What was the cost of that culvert?—It cost a guinea a yard.

2772. And it was a quarter of a mile long?—Yes.

2773. (*Chairman.*) Altogether 400*l.* or 500*l.*?—Yes.

2774. (*Mr. Harrison.*) We have had it stated in evidence, that during the summer time the dredgers upon the Aire and Calder have been chiefly employed in the different branches of the canal dredging sediment which has settled from the water itself. After floods they are chiefly employed in the river dredging away shoals ?—Yes.

2775. Have you remarked whether the river purifies itself in its course ?—No doubt it rapidly improves, but it depends upon the character of the materials put in. There is a manufactory which has been recently established for the manufacture of oil out of the soapsuds ; there is something which they use in that process (they turned it into the river until the culvert of which I have spoken was made) which seemed to be as bad when it got to our mill as when it was first put in, and if it touched anything it soiled it at once. We are not troubled with it now. As a rule, the stuff clears very quickly in the open river.

2776. Does not that seem to point to the pollution being a matter which might be extracted by some means or other without much trouble ?—I do not know that I am able to give an opinion upon the subject, but so far as I know, I should say that the extraction of the liquid portion of the colouring would be difficult.

2777. (*Chairman.*) That is a matter for a chemist to answer ?—Entirely ; about that I know nothing.

2778. (*Mr. Harrison.*) The dye matter gives a colour to the water just like wine ?—Exactly.

2779. Does not the fact which you have mentioned, of the water gradually becoming purer, show that there is a considerable quantity of matter in suspension which settles to the bottom as it goes along ?—Yes; what I should call the solid portions of the liquid matter go gradually but quickly to the bottom ; but besides that, although there seems to be a large stream of objectionable liquid going in, yet the immense body of the river appears to take it away and to dilute it.

2780. According to the evidence which we have had, the manufactures are increasing so rapidly that in the course of a few years there would be a possibility of the Calder being made as bad as you have stated the water to be at Batley ?—Yes, and the river Aire at Leeds I believe is so.

2781. (*Chairman.*) With regard to your own municipal government, have you at all considered the question of utilizing your sewage ?—No, we have not had a debate upon it. There has been a plan talked of occasionally, whether it will be possible to form a large drain down the side of the river Calder, and to put the sewage on to some land there, but it has never come before us in any practical shape.

2782. You have a large river, and the nuisance has not gone to such an extent amongst your other pollutions, as to call for special consideration ?—That is the case.

2783. But when you are considering specially how you are to prevent river pollutions, you will find that that particular branch must come in for its share of notice ?—No doubt.

2784. Have you seen any of the places where sewage is being applied to land for agricultural purposes ?—No.

2785. You have, perhaps, read of some of them ?—I have met with a large farmer and spent an evening with him, who is farming land at one of those places near London.

2786. At Croydon ?—Somewhere in that district; he told me that he had a very liberal allowance given for the damage done to him by the sewage coming there, and he said that it was a very lucky thing that it did come, because it improved his land to such an enormous degree, that he never before grew such crops in his life.

2787. Is there any agricultural land immediately below Dewsbury, upon which sewage could be laid ?—I should say that there is not, the land is so thickly populated.

2788. It would have to be pumped inland ?—Yes ; the land on the river Calder is regarded by the owners of it as good building land.

2789. It is always liable to become building land ?—Yes.

2790. And it would bear a high price if it had to be treated for any purpose ?—It would.

2791. Therefore, you must go away from the river frontages ?—Yes.

2792. (*Mr. Harrison.*) The land being so valuable, and likely to become so much more valuable, would be able to bear the expense of removing sewage from it by pumping ?—It would bear it, I daresay, if the work was not too expensive.

2793. If the margin of the river is considered as building land, the nuisance would be intense of having the Calder turned into a public sewer ?—It would. That land would be able to bear the expense to which you refer so soon as it was built upon, but not before.

2794. (*Professor Way.*) You have said that you think that if reservoirs were made subsiding tanks, on any scale for taking the waste waters of the mills, they would be apt to smell badly ?—Yes.

2795. That I suppose would be from the accumulation which would arise during rest, and from fermentation setting up ?—Yes.

2796. But supposing the waste dye liquids could be dealt with as they were made by artificial filtration of any sort, or by chemical means, so that the objectionable matters were not accumulated in that way, I presume that it would not follow that there would be any such nuisance ?—If you did not accumulate them of course that would be so, but the process through which you put them would naturally produce some refuse ; and the question is, what would you do with that refuse ? If you put the refuse in any reservoir and let it remain there, I believe that the stench would be worse, and would be more injurious than the pollution of the river would be.

2797. You refer to collecting the waters and allowing them to stand in large quantities on the premises ?—Yes.

2798. But as you have not contemplated any chemical means of dealing with this refuse, you are not able to give an opinion whether it could not be prevented by chemical means from becoming a nuisance ?—I am not.

2799. You have said that the soap refuse is the most likely to produce objectionable smells and nuisance ?—Perhaps the soap would be a little the worst, but I do not think that there would be very much difference between that and other refuse.

2800. Do you think that the logwood would produce equally bad smells ?—I think that all the dye wares together, put into one reservoir, would make a stench almost equal to soap, perhaps not quite so bad.

2801. Do you mean including soap ?—I am now taking it on your basis of the soap being separate.

2802. Is there anything in the dye stuffs used which should produce an objectionable smell when wetted with water, logwood for instance ?—Perhaps logwood alone would not; but if you took all the various dye wares which are used, and put them all into one reservoir, I think that they would smell.

2803. Do you not think that you are confusing the fact that you very often put in the soap liquids which contain urine and dung ?—I am not able to give an opinion upon that point, there are, I have no doubt, dyers who could tell you.

2804. You have described to us the sort of pipe through which the water comes for your works on the Calder ?—Yes.

2805. You said that as you had plenty of water you used it abundantly ?—Yes.

2806. Supposing that it were an object to all the dyers, and all persons who use, and to a certain extent pollute the water of the river, that that pollution should cease, do you not think that the quantity of water used could be considerably economised; for instance, if after having used it, it had to undergo

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any subsequent treatment?—I have no doubt that we ourselves could economise it a little.

2807. Without any serious inconvenience?—There is only this to be said, that if you economise water in cleansing any kind of wool or cloth you do not do the work so well, because the more water you have, in reason, the cleaner you get your material.

2808. May it not be that because you generally have plenty of water, you therefore use it?—Before we had a mill upon the Calder we could never get our pieces clean.

2809. You no doubt are aware that in alkali works and other cases of that sort where it is a necessary thing to economise water, so that there shall not be much to evaporate afterwards, means are taken so that the material passes through liquids of different strength?—I am not capable of giving any evidence upon that point. I am not practically acquainted with dyeing.

2810. Is the grease taken from your works?—Yes.

2811. Do they take the cake away?—They take everything.

2812. Do you know what that is used for?—I do not. They pay so much.

2813. You probably have some land of your own?—Yes.

2814. Have you ever tried the cake on the land?—Never.

2815. I was informed this morning that the cake, after the oil is expressed, is very largely used for manure in this district, and that it is a very great advantage?—I never heard that, I should say that it would be very good manure, judging from what it comes from, namely, soap.

2816. You told the Chairman that your experience pointed to the fact that the refuse dyewoods were injurious to land?—Yes.

2817. Do you think that that would be from anything in the woods themselves, or from any of the materials, such as iron, tin, and so on, which might be washed from them?—I do not suppose that dye wares can ever be made useful as manure; they may be, but I should think not. The acids, vitriol, and so on, are very injurious.

2818. If the woods themselves with portions of the liquid hanging to them are objectionable, the liquid itself would be still worse?—I should say so.

2819. Has it been tried?—Not in my experience.

2820. If that liquid were run into the common sewer, do you think that the sewage would be applicable to land?—I should say that it would, but I do not know. The dye water would form a small portion of the whole.

2821. (*Mr. Harrison.*) Would it be possible to obtain from the owners of the eight mills, which have formed this sewer, the quantity of wool which they dye and the quantity of water daily passing at the end of the culvert?—Yes, I daresay that they would have no objection to give that information, they could tell the quantity from the number of machines. Some of those mills are joint stock mills, there were two such, but I believe that one has been bought by the owner of a private mill, and now I think there is only one joint stock mill. The sewer is visible at the outfall.

2822. (*Chairman.*) And we could gauge it?—Yes, but it varies very materially.

2823. According as you may be working the vats at one time more than another?—Yes; in the evening all the pans are emptied, and then it is nearly full; I believe that it would be a very difficult thing to ascertain the average volume of effluent water.

Mr. J. Bates.

Mr. John Bates (Dewsbury) examined.

2824. (*Chairman.*) What business do you carry on?—I am a carpet manufacturer.

2825. Dyeing is involved in that manufacture?—Yes.

2826. How long have you carried on business in this district?—19 years.

2827. What number of hands do you employ at your works?—About 70 weavers I think. I do not know the number engaged in the dyeing and spinning.

2828. For what portions of the process do you use water?—For dyeing and scouring.

2829. Have you any idea of the volume of water which you use in a day?—I never calculated the amount, but we have a 9-inch pump pumping the whole of the day, making about 30 strokes to a minute with a 2 feet stroke.

2830. By "the day" how many hours do you mean out of the 24?—10 hours a day.

2831. Where are your works situated?—In Dewsbury on the banks of the river Calder.

2832. Do you use the water from the river Calder, or from any other sources?—From the river alone.

2833. You have no wells?—No.

2834. And you do not use the town's water?—No.

2835. Is it sufficiently clean at all times of the year for your purposes?—Of late we have had cause to think not, but we have thus far made it answer.

2836. Have you any filter beds?—No.

2837. Or any settling tanks?—Yes, we have a settling tank.

2838. What area does it cover?—It is about 60 yards in length, by 15 in breadth, and with a depth of 10 to 12 feet.

2839. It is wholly artificial?—Yes.

2840. How often do you find it necessary to cleanse the sediment out of it?—We have only cleansed it twice in the 19 years that I have been in the place.

2841. How do you cleanse it out?—By putting a drain from the tank to the river.

2842. And washing it out?—Yes.

2843. Did the people on the river below you find no fault with you for doing that?—A little.

2844. But you went through with it?—It was done before they found fault.

2845. From that have you reason to anticipate that if you repeated it they would perhaps be quicker the next time?—Perhaps they might be, but they do not know exactly where to put the blame.

2846. What depth of sediment had accumulated?—The sediment was about 3 to 4 feet deep the last time that it was cleansed out.

2847. What did it consist of?—Of black pulpy matter, apparently without any very solid particles about it.

2848. Did it smell offensively?—No, there was no smell about it that I could detect.

2849. Do you know what the sediment came from, was it a sediment from the dye vats?—It could only come from the water pumped from the river, but I should suppose that it would be not only from the dyeworks, but from the scouring processes through which the water had been.

2850. Would it have soap in it?—No doubt it would have soap and oil, and the colour of the liquid from the dye vats.

2851. Would it have the spent logwood, and other sorts of woods?—Not the wood itself, but no doubt it would have the colour from the woods.

2852. (*Mr. Harrison.*) Was this a reservoir into which you took the water from the river for the purpose of allowing the stuff to settle, so that you might use that water in your mill?—Yes, it is pumped by the engine from the river into a tank 20 feet above the river, and it is there allowed to settle, and it is used for scouring and cleansing purposes afterwards.

2853. It is not the water from your mill?—It is not.

2854. (*Chairman.*) Then any dirt which comes into that tank has come from the river and not from your works?—Just so; we take it above the point where our water is sent in.

2855. If it has come from works at all, it has come from somebody else's works?—From works above.

2856. From your experience do you think that the river is becoming more impure than it was when you first knew it?—Yes, considerably so.

2857. This refuse has necessarily accumulated faster?—The accumulation is not seriously greater. My impression is that the colouring matter which is the greatest obstacle deposits very little.

2858. And that remains in the water?—Yes, it is suspended.

2859. And you are obliged to put up with it for your own washing?—Yes.

2860. Have you tried any chemical process of getting that colouring matter out. I mean by lime, or by any other means?—No, but when the water has got into the dye vessel for certain purposes, say for instance a scarlet or a crimson dye, or any bright colour, of course the colouring matter has to be precipitated by solutions of tin, or other matters which we know will answer the purpose.

2861. In order to take the colouring matter out of the water before you put your dye matter in?—Yes; we use mordants, and in the last few years we have found that it requires perhaps half as much more of these mordants as it would have done 12 years ago.

2862. Then whatever cost it may be, it is an additional cost upon your manufactures?—Yes.

2863. And if you could get the water purified equally well by some other process, at no great cost to yourself, you would not be injured?—If the water could be rendered as pure as it was when we commenced the manufacture, we certainly should not be losers by paying something for that improvement.

2864. Something equivalent to what you are now paying?—Yes; say on the production of one of these bright colours at least one-third of its cost.

2865. Is it within your knowledge that the dyeing of bright colours has been driven away from any part of the district on account of the difficulty in getting water of sufficiently pure quality?—I cannot say that it is within my knowledge, as we have never allowed it to go from us, and I cannot speak for other people.

2866. If you had the choice between having at an additional expense a water sufficiently good for your purpose without treatment, such as you now use, and having foul water for nothing, which you have to treat before using it, which would you prefer, the naturally bright water or the artificially made water?—The naturally bright water.

2867. Is there any disadvantage in using a chemical ingredient; does it at all deteriorate the water? Is the water so treated inferior to a naturally bright water, or is it equally good?—To some extent it deteriorates the handling of the goods and makes them more hard.

2868. It produces an effect which you would rather be without?—Yes.

2869. Though it answers the purpose as regards clarifying the water it is not for your purposes so good as a naturally bright water?—Certainly not.

2870. (*Professor Way.*) You use more mordant than you formerly used?—Yes; the water being so much deteriorated we first put in a small quantity of mordant, which has the effect of precipitating these matters which float on the top as a sort of scum.

2871. (*Chairman.*) You use it as you would use the lime process, namely, to throw down a precipitate?—Yes.

2872. Do you burn the spent dyewood?—Yes, we mix it with the coal; we throw it amongst the coal.

2873. Did you hear the mayor examined as to the impossibility of discharging the colouring matter from the dye refuse by any process before it is passed into the rivers or streams?—Yes; I do not know of any process by which we could manage it.

2874. Have you heard of any attempts being made to precipitate the colouring matter?—No.

2875. Did you ever know of dye water being put on land for irrigation purposes?—No.

2876. Do you think it would kill grass if used for irrigation?—Unless it was very much diluted I have no doubt it would. I should not say that the alkalis contained in it are really injurious to the land, if they were diluted sufficiently. We know from artificial manures that nitrates and ammoniates are largely used, and in this dye water we have large quantities of those. Ammonia, for instance, is very useful on land, and we use an immense quantity of it, and of the various nitrates as well; but it is possible that they may be injurious in the concentrated state in which we send them out for the land.

2877. I suppose if ordinary urine were put on grass land it would have a very injurious effect?—I suppose so.

2878. It has been intimated that in this district actions have been brought against dyers, and that they have by some processes of their own on their own property got rid of the evil?—Do you mean as to discharging the colouring matter of the water?

2879. I mean by pumping the refuse up and using it for irrigation of land, and letting the effluent waters flow down into the stream?—I know of no process by which the colouring matter can be extracted from the dye water.

2880. (*Professor Way.*) And the water be preserved at the same time?—No; I know that by settling for a month it would not lose its colour.

2881. (*Chairman.*) When passed into a running stream have you noticed that it is rapidly dissipated or apparently got rid of in the body of water?—By dilution, nothing more; nothing is deposited I believe.

2882. Have you, in your own experience, ascertained whether oxygen has the power of bleaching colouring material out of water as well as of diluting it?—Oxygen has rather a tendency to deepen some colours. I do not say it is so in all, but I know it is so in some, and that being so I should not think that when we send out a mixture of all colours oxygen would bleach out the colouring matter.

2883. (*Professor Way.*) You have just told us that you find these objectionable colours in taking the water from the river into your reservoirs, therefore they are not all got rid of?—No, they are only diluted.

2884. (*Chairman.*) What colours are heightened by oxygen?—Blues, for instance, which are the most important colours, perhaps, in this district.

2885. Indigo blues?—Not only those, but the prussiate blues, dyed with the prussiate of potash.

2886. Have you not tried any chemical means for discharging the colour?—No.

2887. Have you not tried what filtration through vegetable soil would do?—No.

2888. Have you ever seen sewage put upon land going on of a dark coffee colour?—No, I know nothing of farming practically.

2889. Do you think that the refuse from tan pits and tanning, if put upon land and passed through the surface, would come out bright?—I cannot give an opinion upon that matter. Sulphuric acid is very much used in dyeing, and I do not know any means of filtration that would take that from the water when mixed with it, it is really a chemical combination and filtration appears to have no effect upon it.

2890. Have you any fear of over legislation in regard to this matter?—No.

2891. Do you think it is necessary that there should be any legislation to prevent you and others polluting the rivers, or would you rather be left alone?—I may say that I have no fear of any legislation affecting manufactures injuriously.

2892. You think that the manufacturers would find ways and means to look after themselves?—Yes.

2893. (*Professor Way.*) Is there any prospect of your getting out of the present condition of things without external pressure of some kind?—Certainly not.

2894. You would rather that external pressure, if moderate and reasonable, should be used than that things should continue as they are?—I believe that it is within the reach of science to devise means to remedy the present state of things. I have no objections personally to its being tried.

2895. (*Chairman.*) If you had a larger tank than

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your present reservoir, and took a longer time, you would get the water into better condition ?—No doubt.

2896. (*Mr. Harrison.*) What manufactures are carried on now besides the woollen manufacture ?—I do not know of anything causing river pollution, except the woollen manufacture in its various branches.

2897. Have you no chemical works of any kind ?—They are very small in Dewsbury.

2898. (*Chairman.*) Are you troubled at all by ashes getting into your tanks ?—No.

2899. Do you know whether ashes, foundation materials, and that kind of dirt come down the river ?—I believe that such things are thrown into the stream, and in cases of flood we occasionally have the pump blocked with refuse a little, but not otherwise.

The witness withdrew.

Mr. A. Tweedale.

Mr. Alderman TWEEDALE (of Dewsbury) examined.

2900. (*Chairman.*) How long have you known Dewsbury ?—70 years; all my lifetime.

2901. Are you engaged in manufactures ?—No.

2902. Have you ever been ?—Not directly.

2903. You were formerly connected with the local board, I believe ?—Yes.

2904. Have you had occasion to observe the condition of the rivers and streams in Yorkshire ?—Yes.

2905. There has been, I suppose, an enormous growth of trade in the last quarter of a century ?—Yes.

2906. From that growth of trade I assume that the rivers have received a great amount of additional pollution ?—No doubt.

2907. As the trade extends, that pollution, I suppose, will extend, if something is not done ?—I presume so.

2908. Do you know the condition of any of the becks in the vicinity of Dewsbury ?—Yes; two or three immediately around.

2909. Are they very foul ?—Yes, as foul as they can be.

2910. Were they comparatively pure when you first knew them ?—Yes, and I have seen fish in them.

2911. I suppose there has been a very rapid growth of population within your recollection ?—Yes.

2912. Dewsbury itself has grown from a village to a town ?—Yes, into a borough now.

2913. Have you considered whether legislation may be necessary to prevent the continued and increasing pollution of the streams in the district ?—I think without it the streams will never cease to be polluted.

2914. If some external authority or some additional control is not set up, do you believe that the evil will go on increasing ?—That is my opinion.

2915. If the present state of the river is an injury to manufactures, there will be a greater injury when the pollution has increased to a greater extent ?—Certainly.

2916. (*Mr. Harrison.*) What was the size of the town in 1800, or thereabouts ?—I cannot give you the number of the population, but it was very small indeed.

2917. Was the Calder, when you first recollect it, a bright and clear river ?—Yes. I can give you one instance which will enable you to judge for yourselves. I have seen a gentleman wade into the stream with his rod and line, and his basket on his back, and stop there casting his line for hours, and occasionally dropping a fish into his basket; that is as long ago as I can recollect.

2918. When did the pollution of the rivers commence to a serious extent ?—I should think seriously, perhaps, in the last 20 years.

The witness withdrew.

Adjourned to to-morrow at half-past 10 o'clock.

Dewsbury, Tuesday, 23rd October 1866.

PRESENT :

ROBERT RAWLINSON, ESQ., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, Esq. | Professor JOHN THOMAS WAY.

Mr. C. Oldroyd.

Mr. CHARLES OLDROYD (of Dewsbury) examined.

2919. (*Chairman.*) You are clerk to the local board of Thornhill ?—Yes.

2920. How far is that from Dewsbury ?—From two to three miles.

2921. Is Thornhill a township ?—Yes, and it contains 2,564 acres 1 rood and 26 perches.

2922. What is the rateable value of the township ?—I do not remember, but I will furnish you with that.

2923. How long have you been placed under the Local Government Act ?—Three years.

2924. It appears that at the last census the population was 1,559 ?—The population of the township was 3,479 at the last census.

2925. Have you carried out any works at Thornhill ?—We have tried to carry out some small works in the township but have not been successful in consequence of the opposition of one of the landowners. I mean waterworks; we have not attempted to carry out any system of sewerage.

2926. Do you contemplate sewering the township ?—Not at present.

2927. For what purpose did you adopt the Local Government Act ?—To control the manner in which buildings were erected, and to enable us to deal better with nuisances.

2928. Are there many mills in your township ?—There are four or five mills which have been recently erected.

2929. Is there any probability that they will extend ?—Yes, they will extend rapidly, especially in that part belonging to Captain Savile.

The witness withdrew.

Mr. W. P. Maddison.

Mr. WILLIAM PORTER MADDISON of Thornhill, near Dewsbury, examined.

2930. (*Chairman.*) The river Calder is the boundary of your township for a certain distance ?—It is, for 5 miles and 5 furlongs.

2931. The Calder and Hebble navigation extends over what distance ?—Over a distance of 4 miles and 5 furlongs.

2932. Is the township on both sides of the river, or only on one side ?—Only on one side.

2933. And on only one side of the navigation ?—We have land on both sides of the navigation.

2934. Is there any water supply in your township ?—None, except from casual springs.

2935. There is no proper supply of water?—There is no proper supply.

2936. Do any of the inhabitants resort to the river or to the canal for water?—A great number of the inhabitants in that part called Thornhill Lees do resort to the canal for water for all domestic purposes.

2937. Is that water pure?—It is very impure.

2938. From what cause?—We suppose from the deleterious nature of the refuse which is thrown in from mills and manufactories above us; dyeworks and such like.

2939. Do you ever see dead animals floating in it?—Frequently.

2940. In the canal?—Yes.

2941. And in the river also?—Yes.

2942. Do you consider that that water is fit for domestic purposes?—I think it is very unfit indeed.

2943. Has your attention been turned to the question of obtaining a better supply?—Yes; from the first formation of the board, I, as well as all the members of the board, have been quite alive to the fact that the use of this impure water was very likely to breed fevers and ill-health of all descriptions, and it has been our very great desire to remove the cause by placing within the reach of the inhabitants some other proper source of water supply.

2944. What source have you been looking to?—The first source that we thought of was water pumped from one of the mines belonging to Captain Ingham.

2945. Would mine water be an advisable source of supply?—We placed a quantity of that water in the hands of Mr. Huggon of Leeds, and obtained an analysis, a copy of which I will hand in.

The same was handed in as follows:

Copy of an Analysis of Water discharged from Hostingly Pit, by Mr. Huggon, of Leeds, in 1865.

"The water is quite turbid, but on standing or by filtration it becomes bright and colourless. One gallon of the bright water contains nearly 42 grains of solid matter, which is composed of the following substances:

Carbonate of soda - -	16·73
Do. lime - -	2 25
Chloride of sodium (salt) -	11·55
Sulphate of soda - -	8·45
Silica and alumina - -	2·82
Grains per gallon - -	41·80

This is a soft and alkaline water, and is suitable for general domestic use; it will not be quite so pleasant for drinking as the hard water, but still better suited for general domestic purposes (except for brewing), contains nothing injurious, and is a water which I can recommend for use."

We came to the resolution that it was too soft for general domestic use. I had a quantity of it taken into my own house, and gave it a fair trial. I found, however, that the effect in boiling meat was to cause the meat to become reddish, as though it had been salted, and also in using it for making tea, it made the liquid almost a perfect black. It is soft, and people like it very much for washing clothes; they find it exceedingly good, and would rather have it than rain water.

2946. Do manufacturers use it for their purposes?—No.

2947. Do you know why that is?—It is delivered at the mine and runs into the goit of a flour mill, and then passes over the weir, and down to the canal.

2948. For what length of time do you think that coal-pit will last, and the pumping continue?—The lease has about 13 or 14 years to run, but there is no doubt that it is a continuous supply of water, inasmuch as it has continued with scarcely any perceptible difference for the last 18 or 20 years.

2949. (*Mr. Harrison.*) What quantity of water is delivered?—About 1,750,000 gallons every 24 hours from the two mines.

2950. (*Professor Way.*) Of the water you have spoken of?—No, about 870,000 gallons of this particular water comes.

2951. Is it used at all for washing wool?—No, it has never been used in any manufacturing process of any kind. The idea that it would be good for manufacturing purposes struck me long ago. I have always considered it a most valuable water indeed for all manufacturing purposes.

2952. I suppose the washerwomen in using it would wash in a stream of it?—No, they have to send a water barrel for it, and pay a little for it, just as an acknowledgment, and the cost of leading is quite sufficient to deter them from wasting it.

2953. If they used a large quantity of it there would be the advantage of a large quantity of alkali?—Yes. In the second colliery at first when we sunk a pit we found the water equally as good for steam purposes and for cleanliness in boilers. When a boiler was tapped the water issuing from it would create quite a foam as though soap had been boiled in it. I have seen the foam standing 18 inches high in the ashpit.

2954. Have you ever made an application to the combined boards of Dewsbury, Batley, and Heckmondwicke to supply you with water?—We have, but they declined at that time.

2955-6. Do you think they would continue to decline taking you as customers?—I scarcely think so, inasmuch as I hear they have undertaken to supply a neighbouring district.

(*Mr. Oldroyd.*) That is the Dewsbury board alone.

(*The witness.*) Just so.

2957. (*Chairman.*) Has any scheme been brought forward for a separate water supply of your own?—Yes; one was brought forward last year, and it commanded universal favour in the township itself amongst the inhabitants; it would have been carried into effect, and I have no doubt it would have been a very successful affair, had it not met with the opposition of one of the neighbouring proprietors.

2958. Was that Captain Ingham?—No; he proposed to do the work himself, and charge 6*d.* per 1,000 gallons for water delivered into the company's mains; the neighbouring proprietor was Mr. Holt, a solicitor, representing Wallis's trustees.

2959. Would 150 or 200 acres have been a sufficient area of gathering ground?—Yes; for the inhabitants that we have or are likely to have for many years, and at all events for 10 or 15 years, we thought it would have lasted.

2960. Are there any springs in that ground?—Yes, there are some.

2961. Then you would not be dependent altogether on the water gathered?—No.

2962. Is there any likelihood of your again taking up the scheme you have mentioned if the difficulties that stood in your way are removed?—We must resort to some scheme or other for we are in that position that we cannot go on as we are; we must adopt either that scheme or some other. I am not sure whether the waterworks company can supply us or not.

2963. Have you made a second application to the Dewsbury town council for a supply from their mains?—Yes, and that is under consideration, I believe.

2964. What is your idea as to the power of local boards to prevent the pollution of rivers?—I think certainly that all local boards, surveyors, and inspectors of nuisances should have the same power as to the pollution of rivers or water passing through their jurisdiction as they are now invested with respect to smoke.

2965. If they used such powers no better than the powers for the prevention of smoke they would not be of much avail?—No; I do not think they would at present.

2966. At all events their powers, if applied to prevent river pollution, would be confined to an area defined for the action of your board?—Just so.

2967. But pollution, I assume, goes on far beyond that area, and where there may not be a board?—That is true.

2968. What form of jurisdiction would you desire and that the impure water pumped from such mines may seriously injure the water of the surface?—In

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to see exercised there?—I should imagine that other places would be able to deal with the matter in the same way.

2969. Do you think that an independent local Conservancy formed of members from the several local Boards, for the prevention of pollution, would not be a better working body?—Yes; I do not doubt that it would be.

2970. Would it be necessary to set up any superintending authority to see that that board did its duty to all parties?—Do you mean to act under the instructions of the board?

2971. You have laws to compel the proper working of mines and proper ventilation, and you have an inspector to see that the clauses of the acts are enforced?—I think it essential that such officers should be appointed.

2972. Does the inspector of mines occasionally visit you?—Yes, occasionally.

2973. How frequently have you seen the inspector of mines upon your premises?—Perhaps a dozen times since I knew the place 10 years ago; he may come every week if he chooses.

2974. You think you are carrying on your mines as well as you can?—Yes; and he has been kind enough to tell me so.

2975. Do you think that the fact that he may come at any time has any influence in keeping you up to your work?—It has not the slightest weight with me as manager of the colliery.

2976. Is that true of all other colliery proprietors?—No; I do not think it is.

2977. You individually would give as much attention as you give now?—Yes.

2978. (*Mr. Harrison.*) Do you think that visitations from the inspectors have a beneficial effect on the management of dangerous mines?—I think they have.

2979. (*Chairman.*) Does the inspector of mines, when he comes, give you information as to new applications, or new modes of ventilation, which may have been adopted, and found successful at other places?—No; he does not give us any information unless he finds that there is something objectionable in the ventilation of the mine he is then viewing.

2980. When he views your mine does he go through the workings?—Yes; a portion of them.

2981. He goes down the pit?—Yes.

2982. And sees what form of ventilation is carried on?—Yes.

2983. If there was an inspector to prevent the pollution of rivers, it would be his duty to see that the different parties were carrying out the regulations laid down?—Yes; I think so.

2984. What power has a mine inspector of compelling attention to his requests?—He suggests that such an alteration is needful, and if the managers object to it he can refer it to arbitration, and so enforce the award, not otherwise.

2985. Then I suppose in the case of the pollution of rivers, if the inspector found that the local board or persons in the district were not carrying out the regulation in the way that he knew it should be carried out, you would not wish to give him absolute authority to enforce anything, but, as in the case of mines, you would empower him to refer the matter to arbitration?—The two things are rather different, inasmuch as the manager of a colliery has a great number of people whose lives are in his care. In the case of the pollution of rivers lives are not so concerned, at least not so directly.

2986. You think that the two cases differ so essentially that the same form of legislation would not be applicable in both cases?—Yes.

2987. You think that some special measure should be devised for the pollution of rivers?—Yes.

2988. (*Mr. Harrison.*) You would have a more summary mode of proceeding in the one case than in the other?—Yes.

2989. Are there collieries in the basin of the Batley Beck?—Yes; several small collieries.

2990. Do they pump much water into the river?—One does at Batley, but to what extent I cannot say.

2991. If they pumped any water, it would probably be of a similar character to that in your collieries?—I do not know that.

2992. What are the names of the seams of coal you are procuring?—We are working three seams of coal, and the nearest to the surface is the Flocton bed; the second is what is called Old Hards, and the third is the Cromwell or the New Hards; there are about 40 yards between. The surface of each bed of coal varies as it crops out; in one case it is 120 yards below the surface of the soil.

2993. Have you workable beds below those three?—Yes; some such are being worked. In other places we have not gone down to them yet. The time will come probably when we shall incur an additional cost.

2994. At what depth would the deepest mine lie that you could reach, in furlongs or yards?—250 yards, it would be necessary to go now. If a seam was lying deeper we should find no difficulty in going down to it.

2995. Are the mines here very wet?—They are well watered, inasmuch as we have water coming from the throws we cut through, but the mine itself, the coal, is not very wet.

2996. The intervening stratification is very wet?—Yes.

2997. That, I suppose, you tub out?—Yes, if needful.

2998. So as not to lift it to the surface?—Yes; that is the case with the Combs Pit, when we sunk the Combs Colliery we passed through the old workings of the Flocton bed, which were lying full of water, and that water we tubbed back.

2999. The tubing is a casing of cast-iron?—Yes; it consists of segments put together of cast-iron.

3000. How do you make the joints?—Simply with a piece of deal without any knots in it, half-an-inch thick, placed in between each joint at first; then we wedge it up at the back, and when we have got it all put in, then we put in small wedges, 4 inches long, into the edge of this sheeting, and drive them up until we cannot put another wedge in.

3001. For the joints of the plates you use yellow pine free from knots dried and dressed to prevent the swelling of the timber when in the joint?—Not altogether; we use perfectly dry wood, which becomes still tighter when saturated with water.

3002. What length of time will such a joint last?—Longer than a metal joint, if it is an up-cast shaft; I should say 20 years.

3003. Do any of those mines produce deleterious or ochrey water?—It is so at the old colliery, part of the water runs down and mixes with the water in the new pit at Combs—that has a large portion of iron in it.

3004. If such water was sent to manufacturers or was to be used for domestic purposes, it would be injurious?—Yes; but that water is not the water of which I have given you an analysis.

3005. Do you know of any collieries not in your district, that are producing ochrey water?—Yes; our neighbour, Mr. Stansfield, had some old pits, the workings of which deliver ochrey water into a brook which we call Smithey Brook, at the other side of the hill, at Thornhill.

3006. And that spoils the brook?—Yes, quite so. Before that water ran down that brook it was noted for good trout, but now there is not such a thing to be seen.

3007. Have any attempts been made to impose regulations upon collieries that have been pouring out this ochrey water, and to prevent the killing of the fish?—Not to my knowledge.

3008. You know of no regulations that have been put in force?—No, none.

3009. I suppose you can easily imagine that collieries may be opened out in a district producing pure water,

some cases it would. I do not know whether you will meet with water in many cases so good as that of which I have given you an analysis, so soft.

3010. What kind of rocks have you sunk through, do you begin in rock at the surface?—At the deepest, down to the Flocton bed, or within a very short distance of it we have rock, and we continue in rock for perhaps 14 or 15 yards.

3011. From which of those seams do you pump the soft water?—From the Flocton bed.

3012. From which does the iron water come?—The iron water comes from some old workings that were in operation many years ago. It came originally from the surface of the district where iron ore was got. Many years ago, I believe, there was a smelting furnace or something of that kind; this ochrey water comes all from that district, from the surface originally, and we are bound to pump it as it flows down through the old workings.

3013. Is there much sulphur and iron in the coal left in the old workings?—No; we do not profess to leave any coal in the old workings. There are cases where the water is ochrey, as at the workings in the Cromwell bed; that again is on a higher level, and the water that comes from those old workings, comes out to the day, it was worked as a day-hole by a drift. We do not happen to have any communication between those workings and the workings of the dip, they are cut off by a large throw.

3014. Where would the iron in that case be collected from?—I imagine from the stratification above.

3015. It would soak down?— Yes; percolating through.

3016. The iron does not come from anything left in the old workings?—The roof would have fallen, and the workings would be open to the action of the air (the air still circulates through those workings) as well as the dampness of the mine.

3017. A description was given at Wakefield of the manufacture of sulphate of iron by exposing the iron pyrites simply to the rainfall and occasionally watering it; then the water issuing from this large bed gave out the sulphate of iron. The process occupied a year?—I have no doubt it would produce the same effect.

3018. (*Professor Way.*) When the ochrey water that issues meets the light, is it very turbid?—No, it is clear.

3019. It becomes turbid afterwards?—The ochrey water is clear but it leaves a deposit.

3020. It only becomes red by exposure?—If you collect a glassful of that water, to all intents and purposes it is clear, but if it is stirred, the sediment which it has already deposited is mixed with it, and it is quite red.

3021. Suppose you let it into a new cut, where there was no deposit already, it would go in clear, but leave a deposit there?—Yes.

3022. The fact being that the iron is in chemical solution when it issues?—No doubt of it.

3023. It is like chalybeate water?—Yes.

3024. You say that you pump this water (*pointing to the same*) out separately?— That is, a distinct pumping.

3025. Have you ever seen these two waters come in contact?—No; the two collieries are a mile apart, as the crow flies.

3026. Does the clearest water contain any alum?—I am sure I do not know.

3027. This water (*pointing to the same*) you say is used for washing purposes, but not generally for domestic purposes?—Yes, not for culinary purposes.

3028. In any of this water that you say may be objectionable, is there anything else but iron, is there any lead?—There is nothing objectionable that I know of in any of the water, excepting the iron I have spoken of.

3029. Nothing poisonous?—No; before this irony water was allowed to come down into the other pit, the horses and ponies in the pit liked the first water that I produced very much indeed, not that of which you have an analysis but very similar to that.

3030. (*Mr. Harrison.*) Do you find that your supply of water varies at different times of the year?—Not in the slightest degree.

3031. A steady quantity is obtained?—Yes, at $5\frac{1}{2}$ strokes to a minute night and day, the whole year through, no matter whether there is excessive rain or excessively dry weather.

3032. What depth is it?—It is 120 yards deep.

3033. Where is the out-crop of the beds of coal?—That bed of coal that is worked runs up to what we call the 40 yards throw, and then it is thrown up within about 50 yards of the surface, and gradually runs out to the out-crop to the westward. As we go to the dip all the beds of coal go deeper and deeper towards Wakefield, and they have more strata lying above them.

3034. Do you not find, as you extend your working operations, that the water increases?—Yes, certainly; as we have gone to the dip we have had more water.

3035. That increase continues gradually but constantly?—Yes, it is quite constant. With respect to the Hostingley Colliery particularly, we have not found any material variations since we commenced with the new colliery, some six years ago.

3036. Does that gather through the roof of the pit into the workings down to your pit?—The principal source of our water at the new colliery comes from the sinking of the pit itself; the water comes to the strata above us, some 30 yards above the bed of the coal itself, and joins the ochrey water when it gets into the bottom.

3037. And that is constant?—Yes, that ochrey water will vary to some little extent, according to the weather.

3038. (*Chairman.*) Showing that its source is nearer the surface?—Yes.

3039. Could not you tub out all that water if the seam is dry?—No, we have unfortunately sunk upon a spot where the stratification is dislocated in all possible ways, and broken up by the throws. We have tried to tub it out every now and then, and have got to the bottom, and for a time have kept that water back; but as we sunk forward we found that we got into some other open strata, and let the water come down again.

3040. It turned your flank as it were?—Yes, it did; ultimately we have had the whole of that water to pump out.

The witness withdrew.

The witness subsequently forwarded the following:—

Copy of an Analysis of the Water at Combs Pit, before becoming mixed with the irony water from the old workings, made by Mr. Huggon subsequent to this Inquiry. *November* 1866.

"One gallon of the water contains,—

Carbonate of lime - Carbonate of magnesia -	16·80
Chloride of sodium	3·50
Sulphate of soda -	14·84
Sulphate of magnesia	9.05
Alumina - -	1·02
Organic matter, a trace.	
	45·21 grains.

"This is a hard water and contains 45 grains of solid "matter per gallon, therefore too hard for general purposes. "Respecting its use for steam boilers it will not be so hard "as it appears at first sight. A great part of the magnesia "will not deposit on boiling, and the carbonate of lime "and magnesia, being deposited in contact with alkaline "salts, will not form a hard crust but a soft friable powder, "which will probably run out or easily scrub off with a "broom."

DEWSBURY.

Mr. J. Charlesworth.

23 Oct. 1866.

Mr. JOHN CHARLESWORTH (of Thornhill) examined.

3041. (*Chairman.*) You are a maltster?—Yes.

3042. Where do you reside?—At Thornhill Lees.

3043. Are you a member of the Thornhill local board?—Yes.

3044. How long have you resided at Thornhill Lees?—30 years.

3045. Have you carried on the trade of a maltster for that period?—Yes.

3046. Where are your works situated, near to the river or the canal?—Adjoining the canal.

3047. How long do you remember that canal?—I have known it for more than 30 years, perhaps 40 years.

3048. Is the water in a different state than when you first knew it?—Yes; it used to be fine and clear, it is quite thick and dirty now, and has been for some years past.

3049. What do you think is the cause?—I expect it is the refuse from the manufactories, what they dye with.

3050. The refuse comes from feeders into the river?—Yes.

3051. Where do the feeders come in?—Opposite Ravensthorpe or Mirfield.

3052. Do you use any water in your trade?—Yes, we steep our barley in water taken from the canal.

3053. What volume of water do you use a day?—We generally steep 48 quarters of barley at a time. I have two kilns; we use a good deal of water.

3054. Do you use water for boiler purposes?—No, we have no engines.

3055. Do you rent the water?—No, there is nothing to pay for the water; we have a right, I expect, to take it from the canal, one of the kilns was bought of the canal company.

3056. It was canal property?—Yes.

3057. Do you think the navigation company would allow any other persons to establish works, and to take water out of the canal without paying for it?—Yes, I believe they would, unless they have altered lately, they used to do so.

3058. Do you find the water as useful for your purpose now as when you first went there?—No, we do not like the water so well; it is very dirty, and it discolours the barley.

3059. Does it injure it?—No, but it discolours it, the barley does not look so bright and well when it is made into malt and dried.

3060. Have you tried to filter the water?—Yes; we tried to stop the dirt and sludge coming into the well, we made the well up with a quantity of cinders to keep the water as clear as we could, and it has improved ever since.

3061. If you had a larger filter of the same material, do you think it would improve the water more?—I think it would, but we have not room, the land belongs to the canal company.

3062. Did you formerly use that water for domestic purposes?—Yes.

3063. Do you now use it for domestic purposes?—No; we fetch it from some springs in Thornhill, about a mile off.

3064. What does it cost you to bring that water?—I employ a man and a horse to fetch it, and it takes them a couple of hours to go sometimes.

3065. What would you value the man's labour at?—I give him 3*s.* a day, and then there is the horse; it cannot cost less than 1*s.* or 1*s.* 6*d.*

3066. Are there any fish in the canal now?—No, I never see any.

3067. Did you ever know of fish living in the canal?—Frequently, and fishers used to come and get a good deal of fish out.

3068. How long is it since they have given over fishing?—A long time, perhaps it is ten or a dozen years since they gave over fishing in our cut.

3069. There are men employed, I suppose, to repair the banks of the canal, bank walkers?—Yes.

3070. Do you ever see any carcases of dead animals floating in the canal?—Yes, frequently.

3071. Do those men take them out?—I do not know, no doubt they would if they were ordered to do so.

3072. You have seen carcases floating about in the water?—Yes, I have, dogs and different animals, sheep and pigs, dogs are frequent enough.

3073. Are the other inhabitants put to the same inconvenience as you are, in consequence of the water being so impure?—Yes, the neighbourhood generally.

3074. Where do they get water from?—They get it out of the same canal.

3075. Have you made any complaint of the foul water?—Yes, it got so bad that we could not use it; but the inhabitants generally are obliged to use it, where they have no means of fetching other water.

3076. How far are you from the river?—Half a mile.

3077. How much are you above its level?—I cannot say, it is almost on a level.

3078. Does the river overflow its banks and flood the land?—Yes.

3079. Does it do any injury when it does so?—It appears to do an injury. Formerly a flood used to do good on the grass land, but now it seems to poison it.

3080. Do you think the floods are as heavy now as they used to be when you first knew the river?—They are not.

3081. Do you think that there is less water in the river in dry weather than there used to be?—I think there is; the flow comes more steady than it used to do formerly; there are more reservoirs to take it, and it comes more regularly.

3082. The flooding of the land formerly was considered an advantage to the farmers, but now you say a flood is considered an evil?—Yes.

3083. Have you thought of any remedy for this neglect of the river?—No; I cannot tell what is the cause, except it be some dye wares, or something of that sort.

3084. Are you in hopes of obtaining a supply of water for your place?—Yes; there are many complaints, and the inhabitants are anxious to have good water, which they have no means of getting.

3085. For drinking purposes?—Yes, we are very anxious to get it if we possibly can.

3086. (*Mr. Harrison.*) Do you throw any refuse at all from your malt works into the canal?—No; we turn the water in again.

3087. What water?—The water in which we steep the barley.

3088. You steep barley in the water, and turn the water off from the barley into the canal?—Yes.

3089. What condition is that water in?—It is rather discoloured.

3090. (*Professor Way.*) And sour?—No; I do not know whether it tastes differently or not. The barley will have been steeped and kept in it for 50 hours; we are obliged to keep barley under water for that time.

3091. (*Mr. Harrison.*) Could you prevent that nuisance by any means?—No; I do not know that we could. We have a right to take the water from the canal and turn it back again, but we have no business to spoil it, and I am not aware that it is spoiled.

3092. Do the canal company require you to turn the water back again?—According to the arrangement we could take what water we wanted, provided we turned it back again.

3093. Do you always steep your barley overhead?—Yes.

3094. Is there not a process by which it is sprinkled?—Yes; we can sprinkle it after six days.

3095. (*Professor Way.*) The inhabitants do not complain of the material you turn into the canal?—I do not think it is objectionable.

3096. Does it smell if it is kept?—It will in warm weather, but we do not work in warm weather.

3097. Is it not the fact, that in some malt kilns

they do not soak the malt at all, but simply sprinkle it?—They cannot manage it without.

3098. Does that depend upon the kind of barley that is used?—No barley does without steeping, they may keep it in 40 hours; I am not allowed to sprinkle after that.

3099. The object is to get the barley fully soaked?—Yes.

3100. (*Mr. Harrison.*) Is there any large extent of land flooded?—Not now; I have seen it more so formerly, any flooding which takes place now arises generally from the back water.

3101. Are there banks raised on each side of the river to prevent flooding?—Not where this flooding takes place.

3102. There are some between Thornhill and Wakefield?—Yes, in some places.

3103. By raising the banks similar to those below you, might not the flooding be prevented?—Yes, it is only the back water that will come in.

3104. (*Professor Way.*) What is done with the sprouted part of the barley, do pigs eat it?—Yes, pigs and cows.

The witness withdrew.

Mr. Robert Lee Rayner (of Mirfield) examined.

Mr. R. L. Rayner.

3105. (*Chairman.*) You are clerk to the Ravensthorpe local board, opposite to Thornhill?—Yes.

3106. Ravensthorpe district is upon the opposite side of the river Calder?—Yes.

3107. For what distance does the Calder front your township?—Ravensthorpe is not a township, it is simply a district taken out of the parish of Mirfield; the river frontage is about a mile in extent.

3108. Of what area is your district?—It is very small, about 350 acres.

3109. What is its rateable value?—Last year it was 6670*l.*

3110. What is the population?—There has been no separate census taken, but we think it is about 1,800 or 2,000; it is quite a new district and has sprung up in the last 10 or a dozen years.

3111. How long is it since you adopted the Local Government Act?—About two years or a little more.

3112. Are there any mills in your district?—Yes; eight mills, I think, one belongs to Mr. Ellis, the mayor, who gave evidence yesterday.

3113. Where do you get your water supply from?—There is no water supply.

3114. What water do the inhabitants use?—They take it simply from wells in the district.

3115. Do they use the river water for any purposes?—I think not.

3116. They resort to wells?—Yes; the people are very badly supplied indeed.

3117. They find a difficulty in obtaining even well water?—Yes; and it is, as I understand, of a very bad sort.

3118. Did they formerly use the river water?—I think the inhabitants have done so, but the district has sprung up so recently; formerly there used to be only a house here and there.

3119. Are there any brooks in your district?—Yes, there is one beck, I think, called the Burgh Beck, that is our boundary on the north-east.

3120. What state is that in?—I think it is pretty pure.

3121. Have you carried out any sewerage in your district?—No; there have been no sewerage works done. The board have obtained a survey of the district with a view of having it sewered, and the difficulty they see is in disposing of the sewage after the works are done.

3122. I suppose at present there is only the river for it?—Nothing but that; but the district is considered too low even for the sewage to be put into the river.

3123. Is any part of the district liable to be flooded by the river?—Yes, the river floods up the Burgh Beck and floods the land; I have seen the land flooded at times.

3124. Have you brought any samples of the water?—Yes; this bottle (*producing the same*) contains water taken out from the Calder below the point where the culvert from those mills spoken about empties itself and that is water from above the point where the culvert empties itself (*handing in the same*).

3125. Also out of the Calder?—Yes.

3126. (*Professor Way.*) Has the first sample been taken out of the river close at the point of contact?—Just below.

3127. Before it is fully mixed with the river?—Yes; this (*pointing to the same*) was taken out when it was fully mixed with the river, and this (*pointing to the same*) was taken out close to the place.

3128. (*Mr. Harrison.*) There is a weir some little distance below?—Yes; this (*pointing to the same*) was taken out above the weir. I have known the river above this district for as long as I remember anything. I always see a great difference in the river on a Monday morning as compared with Saturday, after the works above Mirfield have been standing idle during Sunday, the river always looks much clearer then.

3129. And worse on Saturday than upon any other day?—Yes.

3130. It would look best on Monday?—Yes; on Monday morning I took out some water a mile above this district at Ledgard Bridge; this was taken out on a Saturday and this on a Monday (*pointing to the samples*).

3131. (*Professor Way.*) Do you know generally whether the manufacturers in your district have space enough on their premises for the laying out of tanks, or subsiding reservoirs?—I do not know, I think space is very limited; I think they have not.

3132. I suppose land is very valuable there?—Yes, very valuable.

3133. Is there any land in your district where sewage could be applied for agricultural purposes?—The district is a very small one, and I think there is not space to utilize the sewage.

The witness withdrew.

Mr. John Wormald (of Ravens Lodge, Dewsbury) examined.

Mr. J. Wormald.

3134. (*Chairman.*) Are you resident in this district?—Yes.

3135. Near to Dewsbury?—Yes, at Ravens Lodge.

3136. What points do you wish to speak to?—You asked Mr. Rayner whether the sewage of Ravensthorpe could be utilized, and whether there was any land to which it be applied. I think irrigation would be totally impossible on account of the level of the land being a great deal too low.

3137. That is to say too low for application by gravitation?—Yes.

3138. If pumping were introduced that would remove the difficulty, would it not?—Yes, it might remove the difficulty, but then the land is so level just there, it is too flat; it is too level I should think for irrigation at all events.

3138*a*. Are you the owner of mills?—Not the owner, I am the occupier; my partner is the owner.

3139. Are you engaged in local manufactures?—Yes.

3140. Where do you obtain your water for manufacturing purposes?—We obtain a considerable quantity from the river, and some from the town's water.

3141. You pump the river water and purchase the town's water?—Yes.

DEWSBURY.

Mr. J. Wormald.

23 Oct. 1866.

3142. What do you use the two waters for, take the river water first?—That is used for scouring and dyeing.

3143. What is the town's water used for?—The same purposes.

3144. I assume that you use the river water for the common class of goods, and the town's water for the better class?—I think it is more in this way, that we use the river water when we can, and the town's water when we cannot use the river water.

3145. When the river water is so polluted, you resort to the town's water?—Yes, that is it; I have brought down our miller, and he will speak better to that point than I can.

3146. What number of hands do you employ?—About 600.

3147. What is the nature of your manufactures?—Blankets.

3148. And the process consists of washing and dyeing?—Yes.

3149. What colour do you dye your blankets?—Scarlet, blue, green, and magenta.

3150. Those are, I suppose, for export abroad?—Yes, mainly; and we dye a great deal of wool for the stripes.

3151. Where do you send your dyed blankets to, North America?—All over the world.

3152. Are they used in this country?—Very few.

3153. Do you send them to Australia?—Yes; to China, Japan, and North and South America.

3154. How long have you known the river?—I have known it for about 20 years.

3155. I suppose manufactories have increased very largely within that period?—Very largely indeed. All the mills at Ravensthorpe have been built within I should say 16 years.

3156. Have you paid sufficient attention to the character of the water to know whether it is better or worse than when you first knew it?—It is very much worse indeed than when I first knew the place. Our men used regularly, during the summer months, to get a net and drag the river, and they took out many stones weight of fish. Now I should think there would be very great difficulty in finding one.

3157. How long is it since they netted the river in that way?—I should think 16 or 17 years ago.

3158. What becomes of the water that is polluted, either in dyeing or washing?—We send it back into the river.

3159. Then any person situated below gets all its foulness that you get, and your addition to it?—Yes.

3160. And that process is repeated, I suppose, as far as the river extends and is used?—It is so as far as I know.

3161. As the number of mills becomes largely increased in the district that process, I suppose, will go on?—It will if it is not stopped.

3162. From mill to mill?—I imagine so.

3163. With regard to stopping it, have you formed any definite idea as to what should be done to improve the river and the water?—Allow me to correct what I have said. I have rather committed an error. We dispose of some of our refuse to Messrs. Teall, Le Paige, and Company. The soap refuse and all the dye water goes back to the river, but the thick of the scouring goes to Messrs. Teall, Le Paige, and Company.

3164. What do they pay you a year for it?—About 150*l.* a year.

3165. How long have they taken that refuse from you?—I think they began last year.

3166. Up to that time you wasted it?—Yes.

3167. Do you know what other manufacturers continue to waste it?—I believe there is a considerable number.

3168. I presume you would not consider it any hardship if other persons were compelled to do for profit what you do for profit?—Certainly not. What can be done I think ought to be done.

3169. I suppose there are parties whose mills are not so large as yours, but which produce the same sort of refuse. It might not be worth the while of Messrs. Teall, Le Paige, and Company to fetch it away. In such a case as that, do you think it should be wasted and thrown into the river?—I think not. I think they ought not to be allowed to do it.

3170. If any of your refuse could be utilized, although you might not get a profit from it, would it not be a public benefit if you were compelled to utilize it?—Yes, if everybody else was compelled likewise. At the same time I must say this, that all the water that is taken out of the river ought to be returned to it again.

3171. You do not think it would be an improvement of the river to pump all the foul water away if that were possible?—If the water was not returned to the river the property belonging to mill owners that work by water power would be very considerably deteriorated. I believe this, that if all the foul water that now comes into the river above us were kept out the mill property, of which I am the occupier, would be deteriorated at least 400*l.* or 500*l.* a year.

3172. That is to say, the water is necessary for the trade of the district?—Yes.

3173. And pure water would be much better than foul water?—No doubt.

3174. Do you agree with this. I have been informed by a manufacturer that for dyeing and washing purposes he would rather have a pint of pure water than a gallon of foul water?—I cannot agree with that, because we work 100-horse power by water.

3175. For water-power purposes you want the foul water?—Yes; and if that power were taken away from us the mills would be very little worked.

3176. You would not probably assent to a proposal to take the foul water to an intercepting culvert and carry it past the head of your mill?—Certainly not. We should oppose that by every means in our power.

3177. You would say, purify the water as much as you like, but throw power into the river above us?—Yes.

3178. Is it probable that any attempt at general purification will be made unless Parliament should deem it necessary to enforce it?—I feel convinced that otherwise nothing of the kind will be attempted. We should be very happy to do anything that others did, but at the same time I am quite convinced that a very large number of the manufacturers would not agree upon it.

3179. You would not be able voluntarily to combine among yourselves for such a purpose?—My opinion is that we could not.

3180. Some external power must be brought to bear upon you?—Certainly.

3181. You wish to be helped in a practical manner?—Yes.

3182. In the event of a conservancy board being formed, should it be composed of gentlemen representing the properties to be dealt with?—No doubt; a portion of it ought to be so formed.

3183. And should there be some controlling power to see that that board did its duty?—I suppose that that would be necessary, but I have hardly given the matter my attention so as to be able to offer an opinion.

3184. You seem to have come to a strong conclusion that if left to yourselves there is not much chance of forming an efficient board?—I have no hope of that.

3185. Then there must be some authority to control you?—I think that would be wise if anything is to be done.

3186. (*Mr. Harrison.*) Have you observed that the river has been polluted to this degree within the last 16 or 17 years?—Certainly.

3187. Is the growth of manufactures in the valley of the Calder such that that pollution is likely to go on increasing to a great extent?—I should think so.

3188. So that that which is now merely a nuisance will, in a few years, become intolerable?—I think so.

3189. Within the last few years many reservoirs have been constructed at different places to supply the towns with water?—Yes.

3190. Have you observed what has been the effect of those upon the volume of water coming down the river at different times; for example, has the flood water diminished?—I cannot say that I have noticed that.

3191. Have you a more regular supply of water in the summer season than you used to have?—I cannot say whether we have or not. This year we have had plenty of water, but last year and the year before we ran short of it. I think it was more from the dry seasons than anything else.

3192. You have not experienced any beneficial result in the Calder from the compensating reservoirs that have been constructed in the different valleys?—I really cannot tell.

3193. You have stated that Messrs. Teall and Company take and pay you for the thick of the scouring?—Yes.

3194. Would it be possible to use the water employed in the last process of scouring when it is comparatively clean in the first process of the subsequent scouring, so as not to return any into the river, but to send to Messrs. Teall all the refuse from the scouring process?—I think not; for instance, some of our refuse of the scouring is never sent to Messrs. Teall at all, when we scour with fuller's earth we never send the refuse at all.

3195. What part of the scouring process is that?—Sometimes we scour our goods entirely with that.

3196. And use no soap?—No; or we only use it in very small qualities, but in that case it is not worth Messers. Teall's while to take the waste water. The water is then poured into the river; at the same time so far as scouring with the earth is concerned, no damage is done at all, for the earth is a weighty matter, and sinks down very quickly.

3197. But it removes some of the oily matter?—Yes it does, and the grease.

3198. But not in sufficient quantity to make it worth while to preserve the waste water?—No.

3199. Would water so used be suitable for scouring with soap?—I should doubt it. I do not think it would, as there would be the dirt of the blankets in it, and the dirt of the wool itself.

3200. Could you not separate the dirt very easily?—We could not; the only use I could imagine it put to, would be this; the water could be caught and allowed to settle, and the sediment might perhaps be used as manure, but I think it would be of very little use

3201. It would contain a quantity of oil and some particles of wool?—Yes; and it would be so difficult to take the wool out of it; that causes great difficulty in applying the sediment as manure, especially to grass land.

3202. On what account?—Because you cannot shake the wool loose, to put the sediment evenly over the land.

3203. The wool would be, I take it, good for manure, would it not?—I think not very good. I do not think the wool would be of any use at all; it might be when decayed.

3204. Can you give us an idea of the volume of water which you use in scouring and other processes in your manufactures, for a certain weight of wool daily or weekly?—I could do it, but not at the present moment.

3205. Will you be kind enough to furnish us with those particulars?—Yes.

3206. You say that you use the water of the Calder as power?—Yes.

3207. At the end of the week do you open your sluices, and let the water pass?—No.

3208. At any period of the year do you cleanse out the pond of water that you have above the mill?—Yes, we generally cleanse it once a year.

3209. Do you find much deposit in it?—Yes; there is a very considerable deposit generally.

3210. By what means do you get rid of it; do you wheel it out, or pass it on?—We pass it on. We have a sluice that we can open, and we throw all the filth and deposit in so that the water when it comes in will take it down the sluice.

3211. And then some one else has to send it on again, I presume?—Yes; those below have the benefit of it.

3212. Is there any general arrangement among the mill owners by which this is done systematically on certain days in the year?—I do not know that there is any arrangement, we generally do it on a holiday when the mill is standing, and we can do it without losing the water.

3213. (*Chairman.*) You do not consult anyone either above or below you?—No.

3214. (*Mr. Harrison.*) Would it be any great hardship to you if you were obliged on those occasions to wheel the mud out, and not send it down?—I do not know what could be done with it; we should have to deposit it somewhere.

3215. Would it not make a good manure for land?—I believe not.

3216. Have you ever tried it?—No.

4217. (*Chairman.*) What becomes of the ashes from your mill furnaces?—We have not very much of them; we bury them and raise the land with them; we have a deep pit where we get sand, and we put the ashes back.

3218. You do not throw them into the river?—No; we do not allow that to be done, if we know it.

3219. Do you mend the surface of the roads with them occasionally?—Yes; if we wanted we should do so.

3220. (*Mr. Harrison.*) What is the character of the deposit that you find in the bed of your reservoir?—It is slime and mud.

3221. Should you say it was chiefly refuse from the manufactories above?—I should think a good deal of it was from the manufactories above; a good deal of it is actually mud, that has come down in the floods, all amalgamated together.

3222. If any system of filtration were made obligatory on the manufacturers above you, do you think that that quantity of mud would be diminished?—Decidedly.

3223. (*Professor Way.*) Do Messrs. Teall and Company supply you with a process by which the grease is got rid of?—No; they put up a small pump, and the stuff is pumped across the river, passing through pipes laid along the bed to the other side, where it is received in some works of their own.

3224. And you know nothing of the waste water, but that it is there left?—No.

3225. I suppose that what grease they extract is principally grease from the soap?—Yes; principally from the soap and the oil.

3226. If you are merely washing with fuller's earth, it is only the grease that comes from the wool?—Yes, and there is no soap used then.

3227. And the grease from the wool only is not worth recovering?—I believe they do not consider it so. They pay our miller a certain sum, I believe, to look after their interests in that way; that is, to send them all that is worth having, and not to let them have what is not; I believe that what is not sent to them from the milling would do very little mischief in the stream; the fuller's earth would very soon sink to the bottom.

3228. (*Chairman.*) Do you use much coal for steam purposes?—Yes, a considerable quantity.

3229. Have you paid attention to the consumption of smoke?—Yes. We have consumed our smoke, at least in the boilers, for many years; we have used Robertson's patent, but it requires a considerable draught, and is expensive. We have had to use very superior coal, in fact, house coal. This year, just within a week or two, we have fitted two boilers with Jukes's Patent, and, as far as I can judge, it seems likely to do everything that is required, and be a saving into the bargain.

3230. You think that, with proper regulations, a great portion of the dense smoke, which is now sent

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out into the atmosphere, might be prevented?—I am sure of it.

3231. Do you think that you would require to have some similar regulations for purification of the river?—I think that municipal boards ought to be able to compel it.

3232. Of what persons are those boards usually constituted?—Manufacturers mainly.

3233. Persons who make smoke and also pollute rivers?—Yes; but if they have a certain duty to perform, they ought to be compelled to perform it.

3234. Do you make gas on your premises?—Yes.

3235. What do you do with the refuse from your gas; the lime, or the ammoniacal liquor?—The ammonia is all taken away. I should explain, that we do not make the gas ourselves, there is a gas engineer who makes it; but, I believe, that nothing from the gas goes into the river.

3236. If you emptied the gas tank, would not the contents be pumped into the river?—From the gasometer. I think we very seldom have to empty that; but the gas is under the gas engineer, he makes the gas and supplies us with it at so much per 1,000 cubic feet. I will only add that the eight mills at Ravensthorpe appear to me to have done more mischief to the river than all the other mills put together, at all events as far as we are concerned.

3237. Why have they done more mischief than other mills?—I do not suppose that they are worse than other mills, only that they are just above us. All those manufacturers make heavy goods, and I believe they all use a considerable amount of dye.

3238. (*Mr. Harrison.*) Your mill is situated below those eight mills?—Yes; and we see a very considerable amount of nuisance coming from the beck that runs along the Heckmondwicke valley.

3239. (*Chairman.*) That arises, I suppose, from a combination which benefits the eight individuals, but no one else?—Yes, that is the case.

3240. I suppose that is a form of combination that you would expect to find carried out if the sewerage of the district was carried out by individuals?—Yes.

3241. They may combine for their special benefit, but they would not have the power, if they had the will, to combine with all above and below them?—Certainly not; if the water in their culvert passed any weir, they would be destroying the water power, I think; supposing that anything was done in the way of purifying the river, it would be very considerably to the deterioration both of the navigation and of the millowners' property on the river, where power is used, if the water that was taken out was not returned.

3242. Any scheme for purifying the river must contemplate the maintenance of the volume of water?—Certainly.

3243. (*Professor Way.*) So far as water power is concerned, probably all those mills that lie between the water power above and the water power below, that is, between two water powers, might combine to deal with their material without any injury to the water power, provided that they discharged it finally above the lower mill?—Certainly.

3244. (*Mr. Harrison.*) The fuller's earth that you use I suppose settles in the bed of the river?—Yes.

3245. And it requires to be removed?—It is removed by the floods; but I do not think the amount that is put in is of such importance as really to do any great harm.

3246. Would it be any great burden upon those using it if they were compelled to keep it out of the river by subsiding tanks?—That is a very difficult thing to form an opinion about, and for this reason, that a very large number of the fullers are on such low ground, that all the water to be removed would have to be pumped up. When we are on low ground, if we make tanks, having room to do it, how are we to get the water off?

3247. You could pump it up.—Yes; but that takes a considerable amount of power, and that power is always a certain cost.

3248. (*Professor Way.*) Have you not got settling tanks for the water you are going to use?—No, we have not. I believe it has been found that the water will settle very soon.

3249. (*Mr. Harrison.*) Fuller's earth will settle very rapidly?—Yes; and dye water will settle very soon. I can only say, that I think the only way would be to cause all new dyehouses to be erected upon such ground, that two or three tanks could be used, and the water let out from one to another.

3250. Could the water be let out from those subsiding tanks comparatively pure?—I believe it could.

3251. (*Professor Way.*) Did you ever notice the effect of fuller's earth when mixed with dye water?—I have seen it running into the river, and the two seemed to make a filthy compound together.

3252. If you were dealing with dye refuse water, and you were to discharge fuller's earth into it, would that have any tendency to cleanse the dye water?—No.

3253. (*Mr. Harrison.*) The oily matter that fuller's earth takes out of the cloth might be separated by Messrs. Teall in the same way as the oily matters taken out by soap?—No doubt it might be if it was worth while. I think it would be hardly worth while to do it.

3254. The oily matter that is left in the water used for finishing and cleansing purposes might also be removed?—That is taken away.

3255. After Messrs. Teall and Company have got the thick of the soapsuds I presume that the soap and oily matter left in the remainder of the water, used in the latter part of the process, might also be abstracted if means were employed for that purpose?—I do not know whether it is possible or not.

3256. Has it ever been attempted?—Not that I am aware of, but I believe Messrr. Teall have said that it is not worth their while to do it.

3257. (*Professor Way.*) Do you think that the occupiers of new mills might be required to make arrangements for subsiding tanks?—Yes, I think that would be the only way.

The witness withdrew.

Mr. J. Tattersfield.

Mr. Joseph Tattersfield (of Ravensthorpe) examined.

3258. (*Chairman.*) What are you?—A fulling miller.

3259. Where are you employed?—At Messrs. Cook and Wormald's.

3260. Is much water used there for fulling?—Yes.

3261. Where do you get it from?—Out of the river.

3262. How long have you used it from the river?—Above 30 years.

3263. Is the water better or worse than when you first knew it?—It is a deal worse than it was three years since.

3264. In what respect?—It is very filthy, and in the summer time it works the same as barm; it ferments.

3265. What effect has it upon cloth milling?—Ours are white goods, and they cannot be got so white now.

3266. You want to produce white goods and you cannot get the whiteness that you did formerly?—No; we use the town's water to get the goods whiter.

3267. Are goods less valuable when they are of a bad colour than when they are of a good colour?—Yes; they will not sell for so much in the market.

3268. The use of impure water lowers the value of your goods?—Yes; we cannot finish them so well or make them look so handsome.

3269. How long is it since your goods have been affected in this way by the water?—They have been

affected in this way since we began building at Ravensthorpe, 16 or 17 years.

3270. As the mills increase the water gets worse?—Yes.

3271. If they build more mills under the same conditions I suppose you would expect the water to get still worse?—Yes.

3272. Do you think it might get so bad that you could not use it all?—It is not fit to use now in the summer time.

3273. That is when the river is low and when the weather is warm?—Yes.

3274. Does it at all affect your health when it is fermenting in the way you have described?—I cannot say that, I enjoy very good health.

3275. Does it affect the health of any of the workmen?—I never heard them complain; they get used to it.

3276. Do you think that anything can be done to prevent the fouling of the water which you have seen going on?—I cannot speak as to that.

3277. I suppose you think that if there were fewer mills you would get back to your old state again?—Yes; if there were no mills we should be as we were at first.

3278. It is the multiplication of these mills and the further use of the water which makes this water worse for you?—Yes.

3279. Are all other manufacturers interfered with in the same way as you are?—They are interfered with below.

3280. Other manufacturers below suffer just the same as you do?—Yes; but our grease is sold, and we pump something like three parts of it to Messrs. Teall & Co. One man has 20*l.* a year for turning on valves when it is ready.

3281. They give one man 20*l.* a year for selecting it?—Yes.

3282. All that which he does not choose to have goes now into the river?—Yes.

3283. And those below get the benefit of it?—Yes.

3284. Do any persons above you send that sort of grease into the river?—They all send it in.

3285. Is it that grease or something else which makes the river so bad?—The dye stuff is as bad as anything.

3286. Do you mean that the dye water would ferment if left to itself?—Yes, and the grease along with it, the waste water which comes from Heckmondwicke.

3287. Do you think that the water from logwood would ferment if left alone, without anything else? No; it is the grease which is so bad.

3288. (*Professor Way.*) Is it the grease, or is it the urine and stuff which you mix in the scouring?—We use urine, but we use plenty of ammonia from gas water.

3289. (*Chairman.*) Do you use much pig manure?—Yes.

3290. That would help to ferment?—Yes.

3291. (*Professor Way.*) It goes with the grease, does it not?—Yes; the pig manure gets the grease from the wool, and so does ammonia.

3292. (*Mr. Harrison.*) Do the eight mills which Mr. Wormald spoke of empty their refuse into your pond?—Yes.

3293. Is there any deposit of mud in the river below their outlet above your weir?—Yes, it settles in our dam.

3294. Is that what you speak of as fermenting?—Yes.

3295. The deposit from the refuse from those eight mills?—Yes.

3296. Is it that which Mr. Wormald meant when he said that he thought that the water which you use is more injured by the refuse from those eight mills than from other mills above?—Yes; we have wheels, and it keeps the water discoloured.

3297. (*Chairman.*) How many wheels have you?—Three.

3298. Of what size are they?—I cannot tell you.

3299. Are all of them under-shot?—They are what we call bucket wheels, they are breast-shot.

3300. Are you ever stopped by the river coming in floods?—Yes, by what we call back-water.

3301. So that you cannot work?—We cannot work.

3302. The wheel is brought to a stand?—Yes, it cannot run.

3303. How many days in the year are you in that condition?—I cannot say. Sometimes two or three days in a week; it depends upon the weather.

3304. Have you been back-watered this autumn?—We were back-watered last Friday.

3305. Does the frost stop you?—No, I do not know that it does.

3306. Does not the ice interfere with working the wheels?—No; we have grease to prevent it.

3307. Did you catch any fish in the river when you first knew it?—Yes; I have seen scores and scores of them.

3308. Do you see any now?—No; none can live in it.

3309. How long is it since it has ceased to be fished?—I do not know. I should think that there have been none these dozen years. No fish will live in the river Calder.

3310. What is it which kills them, is it the grease, or the chemicals, or the dye water?—The chemicals I suppose.

3311. Not the dye water?—And the dye water, I suppose.

3312. The chemicals which they put into the dye water?—Yes. The river water has become very hard, it used to be very soft. I think that it is the dye stuff which causes it, the different spirits.

3313. (*Professor Way.*) You say that three-fourths of the soap liquid is pumped across the river?—Yes, something like that. The main quantity of my grease is pumped to the other side of the river to Messrs. Teall's works

3314. Did you ever go across to Messrs. Teall's works?—Yes.

3315. They have subsiding tanks there?—Yes.

3316. They add something to the soap liquid, and let it stand, I suppose?—Yes.

3317. Do they heat the liquid?—No, it is entirely cold.

3318. There are no steam pipes, and no steam is blown into it?—No.

3319. Are the tanks out of doors?—They were out of doors, but they have put a shed to them.

3320. Have you any idea of what size those tanks are?—About the size of this window, they are small tanks. Taking the whole body, they would fill this room.

3321. Do you know how often they run them off?—No.

3322. Do they run them off more than once or twice a-day?—I do not know.

3323. What is the nature of the liquid which runs away, have you ever seen it running away?—It goes into the river again.

3324. Is the pipe above ground so that you can see it?—I cannot state that.

3325. Supposing that you pumped three-fourths of the liquid and that the tanks which receive those three-fourths occupy the space which you have mentioned, I suppose that one-third more tanks would take the whole of the remainder of that liquid, would they not?—Yes, I should think that they would. But we run the cloth longer in clean water when we scour a piece off, which we call finishing a piece; we should run more water with the fourth part than we should with the three fourths.

3326. Do you pump three fourths of the water over and wash with the other one fourth without pumping it?—Yes; when we obtain this grease we put fuller's earth on it.

3327. And you use a considerable quantity of water afterwards?—Yes.

3328. That is the water which Mr. Wormald was speaking of?—Yes.

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3329. Still three fourths of the real soap liquid and grease are sent across?—Yes.

3330. You do not use the fuller's earth with the other fourth, namely, the last quantity after you have ceased to pump?—No, excepting with some goods, with those we always use fuller's earth.

3331. You do not pump any part of that across at all?—No.

3332. You say that a man has 20*l.* a year for taking care that this quantity is stopped off at the right time?—20 of the men share in the 20*l.*; that money is for their trouble.

3333. Have Messrs. Teall ever said that you were sending the refuse over too weak?—No.

3334. How does the man judge that it is time to shut it off; by the look of the water?—Yes, and then it is run into a copper sieve to catch flock from it before it goes.

3335. I suppose that the last few gallons, just before he shuts it off, are much about the same kind of stuff as the next few after it is shut off?—Yes.

3336. (*Mr. Harrison.*) You say that three fourths of the water which is used in cleaning the cloth with soap is pumped across to Messrs. Teall & Co?—Yes.

3337. And the fourth portion of the water is let go into the river?—Yes.

3338. You do pump water from the river for the purpose of this cloth?—Yes.

3339. If you keep the last portion back for the next portion of cloth which you were going to clean would you do so without disadvantage?—No, we should be at some disadvantage.

3340. I mean, if instead of using fresh water to clean the next piece of cloth with soap, you used again so much of the water as Mersrs. Teall had refused to take?—No, that would not do at all, there is no scouring stuff at all in it.

3341. Would it not do as well as water from the river?—No.

3342. Why not?—Because it is not so clear.

3343. Still it would be much cleaner than the water after it has been used in cleaning cloth?—Yes: when we have the taps on we wash the cloth till it is as clean as the river water will give us.

3344. (*Professor Way.*) Still, supposing that you were to begin with fresh clean water, not river water, but ordinary bright water, the last part of your washing would be almost bright water because you continue to wash whilst anything comes away, do you not?—We do.

(*Mr. Wormald.*) What has been suggested would hardly do for us; no doubt if we washed the cloth till we got the water regularly clean we might use the same water back again, but so long as there was any dirt in the water it would not do to wash the pieces in it.

3345. (*Professor Way.*) But you would come back to the dirtiest part of the whole stuff, you would use that water for the first process instead of finishing with it?—Yes; but the point with us is to have as clear water as we can for every purpose, and if we used dirty water for any purpose it would be a disadvantage to us.

3346. You mean that you might adopt such a plan if you had to economise water, but that you would not do it whilst you had plenty of water?—I do not think that it would answer, we should have to put up works and do all sorts of things for it.

3347. (*Mr. Harrison.*) You would merely have to pump the water that had been used for the last quarter of the process of one lot back for the first operation of the next lot instead of pumping an equivalent volume of water from the river?—We should have to use more water for the same purpose. I doubt whether there would be any advantage in the plan.

3348. The whole refuse water would then go forward to Messrs. Teall?—It would never answer for Messrs. Teall, in fact, it would soon stop any connexion between us, if we sent a lot of water which had nothing in.

3349. (*Chairman to Mr. Tattersfield.*) Is there anything further which you wish to add?—No.

3350. (*Professor Way.*) Is the water as you get it fit to make the first class of scarlets?—Not the very first class of scarlets.

3351. If you were told that dirty water was as good as clean and did not make any difference in scarlet cloth, would you believe it?—No.

3352. (*Chairman.*) You are not quite so particular in your blanket dying as they are in some piece dying in getting the very brightest colours?—They are rather particular in some colours.

3353. Do you think that people who buy blankets suppose that a bright colour makes the blankets warmer?—No, but it looks better.

The witness withdrew.

Mr. W. Oates.

Mr. William Oates (Dewsbury) examined.

3354. (*Chairman.*) What are you?—I am a servant to the Aire and Calder Navigation Company.

3355. In what capacity?—I am in no capacity now they have taken all my work from me; I have just the same wages and just the same privileges but very little to do. I have been 40 years with them as foreman of the labourers, messenger, and what they call bank-walker. I entered as bank-walker.

3356. How long do you remember the canal and the river?—Ever since I could remember anything. I was born within about 300 yards of a weir what they call Dam Stones.

3357. What age are you now?—I was 82 the 11th of this month.

3358. Then you remember the river for 70 years?—Yes, very well; my father worked at the mills.

3359. Were the river and canal bright water when you first knew them?—Yes; the river was a little foul in scarce water time; there were many fish about that dam, and they made the water bad. People used to send for water above the Dam Stones.

3360. Because the fish made it bad below the dam?—Yes, after the freshes, when the water had settled.

3361. Do fish make the water foul now?—No, they have gradually diminished.

3362. You have no fish now?—We have no fish now.

3363. What fouls the canal and river water now?—Dyeworks have been the most destructive, so far as fish go.

3364. Have you had anything to do with dredging the river or canal?—Yes; I was foreman of the men nearly 25 years, ordering them what to do, and so on.

3365. Of the dredgers?—Yes. I did not work with them, but I only ordered them what to do under the engineer.

3366. What used they to get out in dredging when you first had to do with them?—In the river there was sand.

3367. And mud?—Not much mud in the river.

3368. Were there any ashes?—No.

3369. What do you now get out?—I have a sample to show you, (*producing the same*) we had four men dredging this morning. I got this out of the water this morning. These things come down with the water to the lock gates and they get in; they are drawn to and they grind the woodwork of the lock gates away.

3370. (*Professor Way.*) This floats at the top?—Yes.

3371. (*Chairman.*) That is a species of pumice?—Yes; it is very like pumice.

3372. Those things float on the water and grind the paddle-wheels?—Yes, whenever you open the gate they grind.

3373. Where do these cinders come from?—They come from the manufactories above, in many places, generally out of the river Colne. (*The witness produced another sample.*) I told our men this morning to get me a bit from out where they last ran the rake.

3374. And that is the sand which they dredge out now?—Yes.

3375. That is sand and gravel and ashes?—Yes.

3376. (*Mr. Harrison.*) That is got out of the river?—Yes.

3377. (*Chairman.*) When you first knew the river, used the bed to be clean sand?—Yes.

3378. Not such dirty stuff as this?—Not such as this.

3379. Does this stink in summer?—I do not know much about this; there is a scour in the river, particularly at the locks when boats are passing through. More particularly up Halifax way.

3380. (*Mr. Harrison.*) Is this sample from a sand bank formed by the late flood?—Yes, by the last flood which came. Very often floods drain the ashes down; and in the parts where we dredge they do not take pains to narrow the waterway, and so the bed makes up again.

3381. (*Chairman.*) What do you think can be done in order to keep this rubbish out?—To a certain extent the navigation company have a law to prevent manufacturers putting any kind of rubbish in.

3382. Does the company put that law in force?—No.

3383. Why do they not?—This power can only go so far as the navigation goes; viz., where the boats go.

3384. Do you know where these things which you have produced come from?—No. About seven years since we sent up to Huddersfield to see what they were doing in the river in the summer time when the water was low at a place called Bradley Mills.

3385. Were they putting these cinders in?—I did not see them do so, but the cinders were in the river, and I could have stridden across over the gap.

3386. And then when a flood comes it washes all the cinders away?—Yes.

3387. And they come down into your lock gates?—They come down into our chinks.

3388. And they get into the cloughs?—These are what we complain of as grinding the cloughs away, and the gates, namely, these swimming things.

3389. A great many sink?—Yes, and they go into the chinks.

3390. (*Professor Way.*) Are there smelting works of any sort above there?—No; I think that these are cinders from the steam engines. As the other part sinks this washes out and floats away.

3391. (*Chairman.*) Do you think that anything could be done to keep these things out?—I think that it could be easily done, as many of them do here; manufacturers here never put ashes in, that I am aware of, and I live close by; they all take them away.

3392. Then you think that all mills ought to take the ashes away?—I do.

3393. (*Mr. Harrison.*) Do you dredge the cuts as well as the river itself?—Yes.

3394. What kind of deposit do you get out of the cuts?—That is mud.

3395. You have not brought a sample of that?—No.

3396. What does that appear to be a deposit from?—It is a very light sediment as it comes down, and gets in, but when it accumulates it is middling solid.

3397. Do you dredge any large quantity from the cuts?—We have begun lately to sluice the cuts as they do at the mill dams.

3398. You have taken a lesson from the mill owners?—Yes.

3399. What becomes of the mud?—It goes down the river.

3400. Do you take opportunities of sluicing the cut during flood time?—No; we take an opportunity here of doing it when there is a feast.

3401. A holiday?—When the mills are standing.

3402. What quantity do you suppose settles there in the course of a twelve month?—On one side it will be 3 feet thick in some places.

3403. How long will it take to deposit those 3 feet?—We do not clean it all at once, or we should almost fill up the river, we must make a nice sort of channel.

3404. How long does it take to deposit the 3 feet in the channel?—Many years.

3405. How many years?—I should think that we cleaned one part out, which is short of a mile long, in 1826, and we have never done anything more to it till within the last 15 years; we never sluiced it or dredged it for that time, namely, from 1826 to 1851 or 1852, I cannot say for a year or two.

3406. What quantity might have settled in that time?—I think that we have sluiced it now three times, and it might get 3 feet thick.

3407. Is there much more sediment now than there was 28 or 30 years ago?—Yes.

3408. I presume that the water in the cuts is tolerably quiet as compared with that in the river?—Yes.

3409. Do you find that the water in the cuts becomes much clearer than the water in the river?—Yes; some which gets in the cut lies quiet.

3410. And does it get clear as compared with the water in the river?—Yes, it is a deal clearer, but I do not know that it is so clear as that it could be used for domestic purposes.

3411. During the period that you have known the river have you observed whether the floods are greater or less than they used to be?—I have a list of all the floods since 1799, but I could not lay my hands on it this morning. I wrote a letter to the papers some years ago when there was some squabbling about waterworks at Halifax, and I have it here, and it talks about some of the floods; they have gradually been diminished since 1799.

3412. There are fewer of them and they have diminished in volume?—Yes; this is the letter which I wrote, it is an abstract; there were 30 other floods besides those that are registered here; but none is registered except it was a flood above 7 feet; the register is kept so far.

3413. In 1799 there was a flood which rose 16 feet 3 inches?—Yes.

3414. The next flood is in December 1815, it is 15 feet 4 inches?—Yes.

3415. In January 1818 the flood was 13 feet 3 inches; in December 1824 it was 12 feet 7 inches; in November 1825, 12 feet. No flood from this time reached 12 feet, till 1833, when the water rose 12 feet and 1 inch. In 1834 there was one flood 13 feet 1 inch, in 1835, 12 feet 8 inches; in 1836, 13 feet 10 inches; in 1837, 12 feet 7 inches, in 1837 again 15 feet; in 1838, 12 feet 2 inches; in 1839, 12 feet 2 inches in January 1840, 7 feet 11 inches; another in January 1840, 12 feet 3 inches; in August 1840, 12 feet 6 inches; in November 1840, 12 feet 5 inches. 1840 appears to have been a very floody year?—Yes.

3416. In 1843, 12 feet 4 inches: in October 1845, 12 feet 8 inches; and again in December 1845, 13 feet 6 inches. In 1852, 13 feet 6 inches; in 1856, 14 feet, in 1857, 14 feet 6 inches; in 1859, 11 feet, and again in December 1859, 12 feet. You do not know the height of the floods since that. Those are all above the low-water level?—Yes.

3417. Do you think that those figures show a gradual diminution?—Yes.

3418. Have you observed the height of the water during summer; is it more regular or otherwise than it used to be?—I should say that the mills could do a great deal more work. I was captain of a boat 18 years, and 30 tons was the general cargo in the summer time; but now boats go up in a deal less time, in a quarter of the time, with nearly double that weight them, namely, 55 tons.

3419. What depth of water did vessels draw which carried 30 tons?—3 feet 9 inches.

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3420. And what do they draw now, carrying 55 tons?—4 feet 9 inches.

3421. Do you consider that in the dry season of the year there are now 4 feet 9 inches of water where formerly there used to be only 3 feet 9 inches?—The mill owners then ran out of one dam into another with all their power. If two parties happened to adjoin one another on the river, which they did at many places, they each ran as hard as they could at the dam till the water was run off. That caused the mill below to run off. The manufacturers were afraid of one getting more of the water than another, but now they agree to run the water nearly dam full and so there is a better and more regular passage, and they do more work at it.

3422. You mean to say that during summer time millers have a great control over the water, and can either pass a great quantity or can keep it back?—Yes.

3423. And they pass it more steadily than they used to do?—Yes.

3424. Do you think that the compensation reservoirs which have been made in the upper part of the river have had much effect?—Yes. I attribute the apparent increase of water to the regular passage, and to so many reservoirs having been made.

3425. Formerly, when there was only a limited quantity of water coming down at certain times, the millers used to fight for it, as it were, but now they know that it will come steadily, and they let it pass off quietly and peacefully?—Yes. Formerly if a shower of rain came down in the night it would almost make a fresh, but now it will rain for a day or two before there is a fresh.

3426. Is any of that extra depth due to the effect of your dredging?—Yes, partly, and partly there has been an improvement in the draught.

3427. You say that the vessels draw a foot more water than they used to do?—Yes; but the vessels which you had of 30 tons would not carry 55 tons at 4 feet 9 inches, but now they have got to know the length and breadth of the locks, and they have got a better system of putting in the goods so as to make the vessel be lighter in the water.

3428. Is the land much flooded near the river?—In 1857 a flood came; I think upon the 10th of August, and it overflowed the land. The land was what we call covered up. The brother of Mr. Charlesworth, whom you examined this morning, had some land down at Horbury Bridge flooded; it was such poisonous water that it killed all the grass land when it lay for any length of time; and he brought an action against the company. What was the result of it I never knew. We were all ready to go to York, and had orders to be prepared.

3429. I presume that any water standing for some time upon land would destroy the grass?—They reckon that grass will live under water for about a fortnight. At this land which I am talking about, below Horbury Bridge, there was seldom a winter in former times when it was not covered.

3430. How long did the water stand upon it on this occasion before it destroyed the grass?—I can scarcely say the time.

3431. Was it a week, or a fortnight, or three weeks?—I should think that it would be a week, but I can hardly say. There were some boys bathing on the 3d of September in the same field.

3432. Has the land been injured since by a flood?—Yes; in the year following, on the 15th of August, there was an overflow again. It did not do that damage to the grass land which the first flood did, but it did a deal of damage to fields of wheat. The first flood on the 10th of August damaged a field of potatoes of six acres just opposite Dewsbury here, and on the 15th of August, in the year following, it flooded the standing corn. As the ground was high the water was flowed off again, and they did not seem to lose much by it.

3433. Is the river embanked so as to keep floods off the land adjoining?—Up to about 1850 there were banks for almost the whole length, but now they have destroyed them very much. In 1857 I think there was a big flood, but it would not have gone on to the land had the banks been good.

3434. Whose duty is it to keep the banks in repair? It is the duty of the landlord.

3435. Who keeps the sluices in repair at the outlets for the drainage?—I do not know. One man wanted to say that we had neglected keeping the outlet sluice, and he said that there was not one, but when we came to look for it it was covered 3 feet thick with mud.

3436. Who removed that mud so as to let the trap work freely?—We did.

3437. The Aire and Calder Canal Company?—Yes. It was the Calder and Hebble Company then. You are aware that the Aire and Calder Company have now rented the Calder and Hebble Navigation. You asked several times whether any complaints had ever been made about the dyeworks above. This is something which I have taken out of a pan belonging to the Stockport Water Company (*producing the same*). They had a trial about some chemical works fouling the water.

3438. (*Professor Way.*) When you are dredging in the river or in the cuts, do you disturb a large quantity of mud and send it floating down the river?—Dredging makes the water thick for a time, we cannot get all the stuff out by dredging.

3439. Does it slip off the pans?—No, it does not slip off the pans, but the water becomes like a puddle, and we bring up as much water as mud.

3440. And you put the mud into the barges just as you bring it up, do you not?—Yes, and then we put it on to the spoil bank.

3441. But I suppose that dredging in the river where the bottom is very muddy makes the water worse for the people below, does it not?—Yes; but there is scarcely ever any mud in the river.

3442. It is only in the cuts?—Only in the cuts; in the river it is generally ashes and sand.

3443. You believe that the mud in the river is carried away by every fresh?—The mud lies more down by Wakefield than it does here, because the river is deeper and there are longer levels.

3444. In fact the mud comes down the river but does not rest in the river, it is carried on?—Just so; a fresh, when it comes, clears it.

3445. Do the men suffer at all in health when they are at work dredging?—I am not aware that they do.

3446. Are you aware whether the mud swells at all?—There is no very disagreeable smell with it; the men are used to it, and they never complain.

3447. Do strangers complain when they happen to come near you?—No.

3448. (*Mr. Harrison.*) Is there any other subject upon which you can give information to the Commissioners?—There is not that I know of. It would be a great benefit to the navigation if ashes and dye wares could be stopped out. When Mr. Ellis the mayor was giving his evidence yesterday, he said that the water which was turned into the river cleared very soon about his works; it is shoally water where his spare water enters the river, but they are bringing the outlet of that drain lower down now. You will see the liquid boil up and rise into a froth a foot square, some more and some less.

3449. That is from the mud?—Yes; when the sun is up and the gases begin to ferment.

3450. (*Professor Way.*) There is a smell at that time is there not?—Yes, there is a smell—a pernicious smell.

3451. I did not quite understand you as to what you said with regard to the fish making the water impure?—They made the water smell fishey.

3452. Were there as many as all that?—Yes; there were millions of what they call minnows; it was at the time when they were coming up the stream to spawn, about May and June.

3453. (*Mr. Harrison.*) What chemical works are there upon the Calder?—There are some at Brig-

house—those are dye works—there are no chemical works till you get to Sowerby Bridge.

3454. What is made at Sowerby Bridge?—All sorts of dyeing wares, it is a very strong concern.

3455. They prepare there the different chemicals for the dyers?—Yes; they have some kind of weed which comes from Thorne which they use.

3456. (*Chairman.*) Is it a kind of grass?—Yes.

3457. What do they use it for?—For chemical works.

3458. (*Professor Way.*) Do you think that that is archil?—I do not know what it is.

3459. Is it like water weed?—Yes, but it is quite dry in bags.

3460. (*Chairman.*) Do you remember Ferry Bridge being built?—I can remember the piles being left in so that the boats got aground.

3461. You remember the old piles being left in?—Yes.

3462. You do not remember the present bridge being built?—No. Formerly there was nothing but wool made.

3463. (*Professor Way.*) In dredging do you find amongst the mud any quantity of short wool?—No.

3464. (*Chairman.*) In the canal and the river are they much troubled with dead animals floating about?—You can hardly go any length of the river but you will see two or three.

3465. When you were bank-walker did you ever make the men take out these dead carcases and bury them?—Not the dead dogs, but there was sometimes a beast. I remember particularly one, and we had to apply to the constable to have it removed.

3466. You let dogs take their chance?—Yes.

3467. Do not you think that it would have been all the better if you had ordered your men to take them out and bury them?—Yes; I once passed through a lock at Manchester with 19 dead dogs in it—dogs about Manchester are very numerous.

The witness withdrew.

The witness subsequently sent to the Commissioners the following paper:

In 1852 Day, Nephew and Co. bought the field near Calder Wharf, and built a mill, to be worked by a steam engine, to have their water supply from the Calder; they have about 140 yards frontage to the Calder.

The year following Messrs. Fox and Pickles bought some ground 50 yards frontage to the Calder about 50 yards higher up the Calder, and built a mill.

Three years later Mr. Edward Hemingway bought 50 yards frontage to Calder and built a mill, and about this time a company bought the ground betwixt Day, Nephew and Co.'s mill and Fox and Pickles' mill, 50 yards frontage to the Calder, and built a mill.

Now about this time (1855) the spare water from the uppermost mill on the Calder was very dirty that the owners of these four mills agreed to make a culvert of brick to convey such dirty water below the Calder Wharf, but the culvert was only carried down to below Day, Nephew and Co.'s feed pipes, and at its outfall a great quantity of rubbish accumulated, so much so that it became requisite to dredge the rubbish out of the river, the owners of the culvert paid the expenses of the dredging.

About this time James Howgate and Sons bought 50 yards frontage to the Calder, and the culvert extended to take the dirty spare water away from their mill.

And now, in 1866, Mr. Ellis has made a culvert from below his feed pipe, 180 yards long, at 1*l.* 1*s.* per yard to the other culvert, to convey the dirty spare water from the five mills above.

Also Messrs. Walker Brothers have made a culvert 150 yards to convey the dirty water to the Calder below their feed pipe, but in attempting to connect their culvert to Mr. Ellis's he stopped the work. This culvert, when finished, will convey the dirty spare water from seven mills for a distance of 830 yards, about half way betwixt the highest mill up the Calder, and Cook and Wormald's forebay cloughs.

The outfall of the culvert is about 40 yards above the outfall of the Heckmondwike beck, which also is very much fouled. These two outfalls being in the bend or bite of the river Calder, the discharge from them does not mix properly with the main stream before entering Cook and Wormald's feeding or forbay cloughs or sluices, so that the fouled water is detrimental to the trade, that of the manufacture of white goods, blankets, &c. Now it seems very wrong to Cook and Wormald to have the water so much fouled, but bear in mind they just do the same as their neighbours with the water, and have done so ever since they bought the estate, about sixty years since; at that date the river water could be used for any purpose, no matter what.

I see by this morning's paper (October 27) that the Rivers Commission have visited Mr. Ellis's works at Ravensthorpe, and will have seen where the Heckmondwike beck and the culvert waters meet just in the bite of the river.

The owners of the watermills and the Navigation Company are the owners of the river Calder, and the water wheel mills were the first to foul the water in the Calder, but not so much as to cause any inconvenience to parties generally using the Calder water till the Mungo Shoddy steam mills were built and the dyeworks on the banks of the river Calder, and then the old fishermen were the first to complain of the fish diminishing, so much so that they could not now make a living with the fishing rod, although they attended day and night. This would be about the year 1853 or 1854.

It is a well known fact that the riverside land is always worth more per yard than the land half or one mile inland, although nearly on a level with river. But suppose that a law was made that any parties in possession of land no matter how far from the river should have a privilege (by paying a reasonable sum for damages) of laying two pipes parallel one with other one to supply the mill with water, and the other to return the spare water, and to be discharged into the river again (after complying with the rules yet to make) above the supply pipe, so that it will be to his benefit to return the spare water as clean as he possibly can, now such a law would be beneficial in a great many ways.

1st. There would be land for large subsiding tanks or reservoirs for the fouled water.

2nd. The mills could be farther apart, and in the event of fire the consequences would not be so serious as at Ravensthorpe with four mills in a space of only 200 yards frontage.

3rd. It would partly regulate the price of land, particularly that nearly on a level with the river.

4th. No parties owning water power would like to let one drop of water pass their works except in the usual way, because as coal becomes dearer water power becomes more valuable.

Well, then, what is to be done with sewage and fouled water? I do not know, but I say that every weir on any fouled stream should have a sufficient number of sluices to open in a flood to scour the bed of the river, also to be opened at stated times in dry seasons.

Yours, &c.

(Signed) William Oates,
Greenwood Lock, Mirfield,
Oct. 30, 1866.

To the Royal Commissioners for inquiring
into the Pollution of Rivers,
&c. &c. &c.

Adjourned to Thursday next at half-past 10 o'clock, at Huddersfield.

Huddersfield, Thursday, 25th October 1866.

PRESENT:

ROBERT RAWLINSON, ESQ., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, ESQ. | Professor JOHN THOMAS WAY.

HUDDERSFIELD.

J. Turner, Esq.

25 Oct. 1866.

JOSEPH TURNER, ESQ. (Huddersfield), examined.

2919*. (*Chairman.*) You are chairman of the Improvement Commissioners of Huddersfield?—I am.

2920*. What number of Commissioners compose the board?—18 for the town, besides three who are appointed by Sir John Ramsden.

2921*. How are the Commissioners for the town elected?—By the ratepayers, and they stay in for three years; six go out, and six are elected by the ratepayers every year.

2922*. What is the population of Huddersfield?—At the last census it was 23,379, but at present it is 37,150, that is for the township.

2923*. The population is increasing?—Yes, rapidly.

2924*. Are the boundaries of the Improvement Commissioners within the township?—Yes, the boundary is 1,200 yards every way from the Market Place.

2925*. The township area is larger than that?—Yes. The number of houses within the boundaries of the Commissioners is about 4,461, and the number of houses in the township is 8,000, the rating is about 8,593*l.*, and from those houses most of the drainage is taken into the river.

2926*. What is the rateable value under the jurisdiction of the Commissioners?—About 98,000*l.*

2927*. Have you carried out main sewerage in certain streets?—Yes; there are five outlets.

2928*. Where do they discharge themselves?—Into the river Colne, and partly into the canal.

2929*. Their contents find their way into the rivers and streams?—They do, except that in several places in the suburbs a species of sewage irrigation is going on, but that is partially stopped now.

2930*. Have you, as Commissioners, had brought to your notice any impurities in the local streams and rivers?—Yes, frequently. It has been stated that the pollution from various sources has been very injurious to health, but I do not think after all, looking at our returns for the last year, that the rate of mortality has been more than in other towns, nor indeed so great; our rate of mortality has been the lowest of any, except Birmingham, Sheffield, Hull, and London. I do not believe that we suffer so much as people imagine.

2931*. You mean from any river pollution?—Yes.

2932*. Do you think the trade suffers at all from the polluted state of the water?—No doubt, one mill taking the water from another causes it to suffer. I can remember when the place consisted merely of small villages, and only three steam engines were employed, but at the present time all the streams and tributaries around are crowded with mills of every description. The water of the river down towards Lockwood is as black as ink in the summer time from the dye waters and various other kinds of refuse, and that must be, I should think, a serious injury to trade. I think it is very desirable, and I think that the inhabitants generally would be very glad to remedy that evil if possible; whether it is possible to do so without injuring manufactures is a very serious question, and one which requires to be treated with great caution. We have two things to consider, first our health, and next our prosperity. Where a mill is built it enhances the value of property and gives employment to the inhabitants where there were poverty and want before, and it brings plenty.

2933*. Have you any power to prevent pollution of any kind in streams and rivers?—I am not aware of anything of the sort.

2934*. Do you know whether it is the practice of any of the proprietors in or near Huddersfield to pass solid refuse into the rivers?—Yes, many of them do so; formerly they threw everything in, even if they were excavating for buildings, all went into the rivers the ashes went into the rivers, and everything; but I think that at some mills they are now utilizing some of the refuse, and I hope in a short time, by some chemical process, a great deal of the evil will be prevented.

2935*. Is it necessary to the trade of the district that the river should be made the receptacle of solid material that could be carted away in other directions if the river did not exist—I think it is desirable to put a stop to that practice.

2936*. Prohibition of that practice would not destroy trade?—No; besides most of the ashes are now used for the roads, and also are ground as a substitute for sand; ashes ground and mixed with lime make capital mortar. I have adopted ground ashes lately in cement upon a building, and I find they are firm and make a stronger cement than sand.

2937*. Supposing that one millowner upon this stream chose to say, I do not think it right to pass those causes of pollution into the river, and in carrying on my business I will do my best to avoid committing this evil, and suppose he went to considerable expense in carrying out his resolution, would his example be necessarily followed either above or below him if no external power existed to compel the adoption of such a course?—I am afraid not without some Act of Parliament. At the same time there is a disposition on the part of manufacturers in favour of an improvement. Many of them cannot wash the pieces in the river water now in consequence of its being so polluted, and there is a serious expense in going to springs for water.

2938*. You think it would necessarily involve some imperative form of legislation?—I do.

2939*. Whatever condition you are now in it would in a measure be hopeless to expect an improvement to arise from improved intelligence alone?—Yes, where interest is concerned. Sometimes people will go on to the injury not only of themselves, but other people.

2940*. Have you an inspector of nuisances?—Yes.

2941*. Have you a medical officer of health?—We have for the guardians.

2942*. And for the town?—We have not, directly.

2943*. The Local Government Act gives you power to appoint a local officer of health, have you appointed such an officer?—Not at present; the guardians act for the parish and the township too.

2944*. Do you think that officers of health appointed by guardians do anything more than look to poor people after the disease has set in, or is it their duty to look to the causes that produce disease?—A great deal more misery might be mitigated, I think.

2945*. Have you on hand now any plan for the extension of your sewerage and drainage?—Yes, for a considerable extension.

2946*. I suppose new mills are being erected?—Plenty.

2947*. Do the Commissioners supply water to the town?—No; the water supply belongs to another body of commissioners.

2948*. Commissioners or a company?—Commissioners. They have no pecuniary aid whatever, they are commissioners for supplying the town with water.

2949*. Has there been any talk of incorporating the town and amalgamating the commissioners?—There has.

2950*. It has not been done yet?—No.

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2951*. Would it be an advantage, or otherwise, to have one local governing body possessed of large powers, including the powers of the Improvement Commissioners, and the powers of the Water Supply Commissioners ?—It is very desirable that they should be amalgamated.

2952*. Do you think that two distinct establishments can be worked more cheaply than one large one ?—I do not know I am sure.

2953*. There would be much local opposition before you could carry out any amalgamation, would there not ?—I think so. We have not settled as to the extent of boundary that we want to include on each side of the water. There is a very populous neighbourhood from Mold Green and Lockwood, and they do not seem desirous to join us, but we think that at some future period they will be glad to go with us.

2954*. Those adjoining townships for the most part have set up their own local boards, and surveyors ?—Yes.

2955*. And their own clerks and collectors ?—Yes.

2956*. Their whole machinery, in fact ?—That is true.

2957*. I believe none of them have any independent public water supply ?—No.

2958*. Neither do the Huddersfield Commissioners extend their mains into the out-districts ?—Partially they do.

2959*. To whom do the gasworks belong ?—To a private company.

2960*. (*Mr. Harrison.*) What was the population of the town of Huddersfield at the earliest period when you remember it ?—Very small, not above 10,000.

2961*. What was the condition of the river at that time ?—Nearly pure; there was very little pollution then in the stream; you might have seen fish in it, and you could see to the bottom of the river, but it was never exactly clear, there were always some mills above which polluted the water at certain times.

2962*. How long is it since the improved system of sewerage was carried out in the town ?—It was carried out in 1848.

2963*. Has it had a beneficial effect upon the health of the inhabitants ?—I should say so; we have not so many cases of typhoid, or scarlatina, or measles, as we used to have.

2964*. (*Professor Way.*) You have spoken of ashes from furnaces being used for making mortar; what proportion of the whole quantity of ashes produced in the district could be used in the district in that way ?—I cannot say.

2965*. Would it be a large proportion, say one-tenth of the whole ashes ?—No; but I have no doubt many discoveries will be made as to the use of waste products when people once begin to look fairly into the matter.

The witness withdrew.

J. Fawcett, Esq.

JOHN FAWCETT, Esq. (Huddersfield), examined.

2966*. (*Chairman.*) You are chairman of the drainage committee under the Commissioners ?—Yes.

2267*. How long have you been a member of the commission ?—Over three years.

2968*. Have plans for extending the drainage of the districts been laid before your committee ?—Yes.

2969*. And as chairman you have to see that they are properly submitted to the board before they are passed ?—Yes.

2970*. Have you recently had many plans laid before you for extending the drainage ?—In the last two years we have done a great deal of main sewerage.

2971*. Have you had plans under your consideration for utilizing the sewage, and for keeping it out of the rivers or streams ?—No.

2972*. Are you aware whether the sewage now causes any nuisance in the streams ?—I daresay it will do them no good.

2973*. Have you had any complaints from the manufacturers below you ?—I am not aware of any. Mr. Abbey has prepared a report, which will embody all the evidence I and many others could give.

2974*. Mr. Abbey I hope has been working with your full concurrence ?—Yes.

2975*. You wish him to give as much information as he can at this inquiry ?—Yes. I believe Mr. Abbey has worked entirely free, there has not been any restraint whatever put upon him.

2976*. How long do you remember the streams near Huddersfield ?—A great many years, perhaps 35 years.

2977*. What condition are they now in compared with what they were when you first knew them ?—They are very much blacker and darker than they were.

2978*. Fouler ?—Yes. But I cannot say the foulness of the stream interferes with the trade of the district.

The witness withdrew.

Mr. J. Brook.

Mr. JOHN BROOK (Huddersfield) examined.

2979*. (*Chairman.*) Are you registrar of this district ?—Yes.

2980*. Are you registrar for the township of Huddersfield or for the borough ?—For the borough, and for the whole township; my boundaries are about six miles in extent, from Paddock to Cooper's Bridge.

2981*. What population does your boundary include ?—In 1861 there were 34,784 persons within the borough boundary.

2982*. The Parliamentary borough ?—Yes.

2983*. What is its area ?—3,900 acres.

2984*. What is its present population ?—37,000.

2985*. Have you the rate of mortality for any number of years ?—From 1851 to 1861 the average deaths were about 2·56 per annum.

2986*. That would be about 25½ in 1,000 ?—Yes.

2987*. What has been the rate in the last year up to this time ?—I cannot give you that, I have it from 1861; it has been about 2¼ per cent. upon the population.

2988*. That is 22·5 or 22½ in 1,000 ?—Yes.

2989*. That has been the average ?—Yes.

2990*. What has it been this summer ?—This summer Huddersfield has stood very well during the prevalence of cholera and diarrhœa; we have had in this district only 21 cases of diarrhœa for the quarter ending 30th of June; only one death from Asiatic cholera, and five from ordinary English cholera, upon the whole population, which is now 37,000.

2991*. According to these figures Huddersfield stands very favourably with regard to its mortality ?—It does.

2992*. Are you aware what the mortality has been at Leeds, Liverpool, and Manchester ?—Yes, and we stand about the lowest, except Hull.

2993*. How long do you recollect this district ?—The whole of my life.

2994*. Since you began to be registrar have you had any cholera epidemic in Huddersfield or the district round ?—In 1849 we had cholera here.

2995*. What was the mortality in that year ?—I have not ascertained that yet, but we had cholera in 1849 to a great extent.

2996*. Had you any cholera in 1854 ?—Not particularly, we had some cases both of fever and cholera.

2997*. Do you remember when the Lodging House Act was established in Huddersfield ?—Yes.

2998*. What year was that ?—I think about 1854.

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2999*. Had it any beneficial effect upon the health of the people?—I consider that the lodging-houses have been a very great benefit to the town.

3000*. Returns of deaths are sent in to you, and you register them for the localities where the deaths have taken place?—Yes.

3001*. I suppose by reference to your books you can tell which district produces the largest per-centage of deaths?—Yes, I could ascertain from the books, but they are not in my possession.

3002*. Can you from memory tell us where the largest per-centage of deaths usually occurs, in what parts of the district?—At Birkby and Fartown.

3003*. Are they near to or distant from the river?—There is a small river that runs down at Birkby, and the place is very imperfectly drained, and very many private drains run into it from waterclosets.

3004*. Has the mortality increased since that arrangement took place?—Yes, in the last four years.

3005*. Has there been a larger mortality in consequence of carrying out those private drains?—Yes.

3006*. Is there any other place?—Sheepridge is a very bad place, that is a couple of miles from here.

3007*. Is that near to a watercourse?—Not very near; it is about a mile from the river Colne.

3008*. Then the river would have no effect in producing that state of things?—No. I should attribute it to the private drainage; the district is not regularly drained at all.

3009*. Are there privies and cesspits there?—Yes, and open cesspools, and complaints have been made of them.

3010*. Has there been an increase in the mortality there?—Yes, upon that population.

3011*. Can you name any other district in a similar condition?—Not now.

3012*. How long do you recollect these streams?—Since I was a boy.

3013*. What condition were they in then as regards their purity?—I used to go into the river and catch fish.

3014*. What condition are they in now?—We have had no fish for years.

3015*. Are the streams discoloured?—Very much so.

3016*. Have you seen the streams polluted by solid materials being thrown in, such as ashes?—Yes, we throw about 300 tons in ourselves every year.

3017*. Are you a manufacturer?—No, but I am executor of a mill proprietor.

3018*. What is the name of the firm?—Kay's executors. In my report to you through Mr. Abbey I have put down 350 tons of ashes and refuse as annually thrown in by our mill from every source.

3019*. Would you consider it a very great hardship if some governing authority were established, and you were told that you must cease to throw those ashes in?—Not if everyone was treated alike.

3020*. Would it be very costly to you to dispose of the refuse in some other way?—We could dispose of part of it, and the ashes might, I think, be disposed of to some advantage.

3021*. At the present time are there any restrictions put upon you, do you see other people doing the same thing; throw refuse into the river as the readiest way of getting rid of it?—Yes. Sir John Ramsden gave us notice a year ago to cease putting ashes in, and we did so for some time, but as other people did not cease also we returned to the old practice.

3022*. Are you aware that the common law of England is sufficiently strong to prevent it?—I have seen reports of that nature.

3023*. If Sir John Ramsden chose to put the common law into force, he could stop you at once?—Yes.

3024*. And he could stop a great many more?—He could not stop us consistently without stopping others.

3025*. It would not be considered friendly for one neighbour to enter an action against another?—No; very few manufacturers would do such a thing.

3026*. It would be better that some independent person should do it?—Yes, Government had better do it at once, and serve us all alike.

3027*. What effect is produced upon the river by passing that refuse in?—As to ashes I do not see that they do any great damage to the water for manufacturing purposes; formerly we had river water, and now we buy it from the canal company for dyeing purposes.

3028*. Can you use the river water?—No.

3029*. Supposing it were brought back to as good a state as the canal water, how much would you save by using river water without paying for it?—We pay 25*l.* a year for the canal water.

3030*. Do you buy any from the waterworks people?—No, except for drinking purposes, and for brewing and so on.

3031*. Have you any wells upon your property?—Yes.

3032*. Do you produce any quantity of water there for manufacturing purposes?—We use the well water for one of the engines when short of water in summer time; it is too hard for other purposes.

3033*. If it is very hard, is it not also injurious for boiler purposes?—Yes; we only use it when we are bound to do so.

3034*. Do you dye on your premises?—Yes.

3035*. What becomes of the refuse water?—It goes into the river.

3036*. What becomes of the refuse from the dye woods?—The woods are boiled in bags, I mean woods such as fustick, logwood, cam-wood, &c., and the solid refuse is emptied upon the coals and burned with them.

3037*. Have you any soap refuse from washing on your premises?—No, we have not.

3038*. Did it ever occur to you to try whether the colouring matter could be discharged out of the dye water?—It did some years ago when we had about 12 pairs of stocks, and if we had continued them we should have used the water and the refuse.

3039*. Have you any spare land on the premises attached to the mill?—Yes.

3040*. Of what area?—From two to three acres.

3041*. Is it grass land?—Yes, and one part is used for stowing the refuse.

3042*. What kind of refuse?—Rubble stones, ashes, lime, or anything else.

3043*. Where does the rubble stone come from?—In digging foundations; we reserve that for road purposes.

3044*. Instead of putting it into the river?—Yes.

3045*. Has there been a large increase of mill property on the stream above you since your mills were established?—Yes.

3046*. Do you find that the increased number of mills above you has any effect upon the water?—Of course the water is more fouled and more discoloured.

3047*. As the mills are added do you find the water in a worse condition?—Yes.

3048*. Do you ever find any inconvenience from ashes being sent in above you?—Yes, ashes have been sent in to such an extent within the last eight or nine years that they have raised the bed of the river from 12 to 16 inches opposite our place.

3049*. Does that increase the flooding upon your premises?—Yes, we have been flooded, had our best mill stuck fast; in extreme wet weather the place will be flooded.

3050*. If you were to restore the river to the state it was in when you first knew it you would have to excavate the bed down to its original depth?—Yes, and it would cost us a considerable sum; we should have about 80 yards in length to do, perhaps rather more.

3051*. Have you a settling pond attached to your mill?—Yes, two.

3052*. Of what area are they?—I think about 1,308 square yards together.

3053*. Do you ever cleanse them out?—Yes.

3054*. How many times in a year?—We flush one of them two or three times a year.

3055*. Do you do that on a Sunday?—Yes, from Saturday night at 2 o'clock till Sunday.

3056*. Where does the material you flush out go to?—Into the river.

3057*. Into the channel?—Yes.

3058*. Of what does it consist?—Refuse and sludge.

3059*. Of mud that has come in from above?—Yes.

3060*. Do you think that if the rivers were purified above you you would have less sludge to clean out?—Very considerably less.

3061*. This mud goes into the river, and it may go into other lodges situated below you?—Yes.

3062*. Then the millowners pass on the mud one to another all the way down the stream?—Yes.

3063*. Have you any idea what it costs you to flush that mud out; how many men do you employ to do it?—About 12 or 14, or just as many as can work.

3064*. That I suppose may cost about 5*l.* or 10*l.*?—Yes, more than that, about 15*l.*

3065*. Supposing you were forbidden to flush mud into the river, what could you do with it?—We must empty it by buckets; we should have to lay it in the yard and let it dry and lead it away; we have done that lately.

3066*. What does it cost you?—I have not entered into that.

3067*. Would it be useful as manure?—I offered it to two or three farmers last year and this year, and they had some of it, but many of them have refused to take it.

3068*. You mean that they refused to cart it away?—Yes, because it was not of sufficient value.

3069*. Supposing you were obliged to offer them money to take it away, would that induce them to take it?—Yes, they might be induced to take it for daily hire.

3070*. Would they not take it away for less, say 6*d.* a load?—We have not tried them; when the water was dried out of it we led it away ourselves.

3071*. Do the gentlemen above you who own mills flush generally at the same time, from Saturday to Sunday?—Some of them flush; at the Marsden reservoir they have been flushing for some time.

3072*. Is that a large one?—Yes.

3073*. What condition has that put the river in?—We could not have that muddy liquid come into our reservoir, so we had to put our shuttle down and to let the stuff go down the river.

3074*. And your works are deprived of that amount of water?—Yes, generally on Saturday afternoon and on Sunday.

3075*. Has that been any disadvantage to you?—Yes, it would have been, if we had let the water get into the reservoir, but we put the shuttle down to prevent it.

3076*. Have you considered the question of establishing regulations to purify the river?—I have not turned that over in my mind.

3077*. Do you think it advisable to continue in the present course, adding mill upon mill, without any regulation for the preservation of the water?—No; individually I should say it would be better if we could have the water pure. The question is whether it would not affect the manufacturers in the district to a very great extent.

3078*. You would not like manufacturers to be so injured that they could not carry on their trade?—No.

3079*. Have you heard that some forms of manufacture have been driven from the district in consequence of the water being impure?—Yes, for fancy dyeing we ourselves were; we used to be dyers of fancy colours, but the water was so foul that we could not carry that business on.

3080*. Was not that a serious injury to you?—No; because we turned our attention to darker coloured work.

3080*a**. Would it not be disadvantageous if Yorkshire should get a bad character for its manufactures?—Yes.

3081*. Can it retain its reputation if it has to turn away its finer articles?—It is a very small item that; fine colours compared with dark ones.

3082*. Might not the time come when the foulness of the water might seriously interfere with the production of dark colours?—I am not a manufacturer myself and cannot speak upon that.

3083*. (*Mr. Harrison.*) How long have you been registrar?—28 years.

3084. In the return you are going to prepare will you be good enough to give us the population of Huddersfield for each 10 years?—Yes; the population of Huddersfield in 1831 I can give you; it was 19,035. In 1841 it was 25,018; in 1851, 30,876; in 1861, 34,784.

3085*. How long is it since you recollect fish in the stream?—When I was a boy.

3086*. How long after that did they remain in the streams about here?—I think they remained till within 20 or 30 years ago.

3087*. Have manufactories increased in the district rapidly in that time?—Yes.

3088*. More rapidly than previously?—Yes, much more so.

3089*. You stated that you gave about 25*l.* a year for water to the canal company?—We have either a 2-inch or $2\frac{1}{16}$-inch pipe from the canal.

3090*. Can you draw as much water as you please?—We could have it running in to-day if we required it at a pressure of something like four feet with that pipe.

3091*. For how many hours in a day do you draw it?—About 10 hours a day.

3092*. Can you give us the weight of wool that passes through your hands to be dyed in the course of a year?—We sublet our works, but I can ascertain that if you wish it.

3093*. You stated that some time ago you thought of endeavouring to purify the water?—A few years ago we had some stocks, and having stocks we used a great deal of soap; then we thought of making these reservoirs, and to sell or use the refuse of the soap and oil for manure.

3094*. It did not deal with the refuse colouring matter of the dye?—It did not.

3095*. (*Professor Way.*) You have stated that you use the water from the canal for your dyeing purposes?—Yes.

3096*. And for washing?—Yes.

3097*. Do you use the water from the stream in your boilers?—Yes.

3098*. Is it good for that purpose?—Yes, better than the other water.

3099*. Does it crust the boilers?—No.

3100*. Does the dye stuff interfere with the boilers?—Not enough goes in to affect the boilers

3101*. It is soft water, is it not?—The river water is soft on account of the soap refuse and the dye wares it receives. Those destroy the iron substance in the water.

3102*. What is the name of the stream on which your mill is situated?—The Colne.

3103*. (*Mr. Harrison.*) For manufacturing purposes the canal company are really a water company?—We find their water advantageous for light-coloured goods, for dyeing and washing purposes.

The witness withdrew.

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Mr. J. H. Abbey.

25 Oct. 1866.

Mr. John H. Abbey (Huddersfield) examined.

3104*. (*Chairman.*) You are surveyor to the Huddersfield Commissioners ?—Yes.

3105*. How long have you been their surveyor ?—About four months.

3106*. Had you been connected with them previously ?—Yes, 10 years ago ; I was their surveyor for three years.

3107*. Was your father surveyor in this district ?—Yes.

3108*. Have you been brought up under him as a surveyor from your boyhood ?—Yes.

3109. Are you well acquainted with the district round Huddersfield, as depicted on the Ordnance sheets ?—I am.

3110*. At my request have you drawn up some information in detail ?—Yes, I have. This map consists of 6-inch contour ordnance sheets, put together and coloured for this purpose. It shows the town of Huddersfield and the rivers flowing into and through Huddersfield from their sources down to the junction with the Calder.

3111*. At what point ?—At Colne Bridge.

3112*. What are the names of the subsidiary streams, beginning with the lowest one ?—The first is Lee's Beck, running up towards Kirk Burton, Shepley, and Shelley. Shelley is the largest village on the stream. The next stream is the Pennydyke, which runs through Mold Green towards Almondbury. The next is the river Holme, which is the principal tributary to the Colne ; the Holme runs through Lockwood, Berry, Brow, and Honley, Thongsbridge, and up to Holmfirth and Holme.

3113*. What are the branches of the Holme ?—The principal one is the Mag Brook, which runs through Netherton up to Meltham.

3114*. Is that the stream upon which some intended reservoirs were to be put for the supply of Huddersfield and some of the intervening townships ?—Yes.

3115*. What are the names of the principal reservoirs on the Holme ?—There is the Bilberry, the Holme Styes, and the Boshaw Whams. The next is Newmill stream ; there are several mills upon it, and it rises above Hepworth. The Colne runs through Huddersfield, Crossland Moor, Paddock, Slaithwaite, and Marsden, up to the Standedge Hills.

3116*. Does it go to the divisional line of the counties of Yorkshire and Lancashire ?—Within about a mile from it.

3117*. Have you depicted on the map the area of the jurisdiction of the Huddersfield Commission in that half circle ?—Yes.

3118*. Do you also show the present outlets into the stream ?—Yes. No. 1 is the Grove Bridge, No. 2 is the Aspley outlet, No. 3 is called Long Bridge, No. 4 is called Shore Foot mill-tail goit ; No. 5 is Longroyd Bridge, No. 6 is the intended outlet to drain the Hebble Beck. Those are all.

3119*. I believe you have tabulated some information for us ?—Yes. I have. (*The same was handed in, and is printed at the end of the evidence of the witness.*)

3120*. (*Chairman.*) You have some other information in a written form ?—I have some information as to the list of townships forming the watershed to the river Colne. The total population is 130,332. 67,152 acres form the area of the watershed, and the annual rateable value is 364,312*l.*

3121*. (*Mr. Harrison.*) That is the whole of the watershed which we see upon that plan ?—Yes.

3122*. (*Chairman.*) What is the other information which you have ?—As to the quantity of excavations passed into the river. In the town of Huddersfield and the neighbouring village of Lockwood the quantity of excavations thrown into the river is beyond conception, and I feel quite safe in the assertion that in Kingsmill Lane alone hundreds of thousands of tons have been carted into the river.

3123*. Within what period ?—Within the last 20 years. Even now a considerable breadth of land has been reclaimed, if I may use the term, from the river by the consolidation of the excavations thrown in—that is, in Kingsmill Lane ; other parts are washed away. In the township of Lockwood for a great number of years back the whole of the excavations of the village proper were shot into the stream, and at the present time great tips of spoil are to be seen positively choking the course of the stream ; and to such an extent has been this practice, that the land on the side of the stream belonging to Sir John William Ramsden, Bart., has been washed away piecemeal until a very considerable inroad has been made into his estate in that locality. In Lockwood filth, garbage, road scrapings, broken crockery, and spoil of every description find their way into the river. Time after time have the authorities endeavoured to check this practice by erecting a fence along the side of the river, but as often as it has been erected so often has it been knocked down, and the practice resumed. Considerable numbers of new buildings have been erected in the village, the excavations from which I have no doubt, at a moderate computation, would amount in the aggregate to 6,000 tons for the last 10 years.

3124*. And all this is carted into the river ?—Yes. At most of the mills on the streams it is the practice to throw the ashes into the river ; and where there is a sufficient current of water to carry them away, one is almost certain to find a cinder tip if there is a mill in the same neighbourhood. The local boards and surveyors of highways in these localities have begun to lead away the ashes, and use them for the roads, but as yet only to a limited extent. To some trifling degree the ashes are used for mortar and asphalte. I am quite confident that but few years will elapse before ashes will be found too valuable to be thrown into the river ; at any rate, numbers of places may be found in which to store them until wanted, instead of depositing them in the streams. As to excavations, these might be used for making new streets, and for raising low-lying lands to a proper elevation, to allow of good drainage. A great source of pollution is created by dyers, nearly the whole of whom discharge their dye liquor into the stream. The water used by Messrs. Kenyon and Armitage for dyeing and scouring is from private reservoirs, the supply to which has been obtained by driving or draining in their own properties, and the water running down the stream is only used for condensing and water power. I find that on most of the streams great numbers of the millowners and dyers have provided artificial means of supply instead of using the natural stream ; and to such a great extent has this been carried out, that comparatively few are dependent upon the rivers for their supply ; and therefore by irrigating the land, or in any way keeping the foul water out of the river, the natural stream would not be sensibly diminished. I have prepared a tabulated statement showing the mills and manufactories on the banks of the Colne and its tributaries. I have found it exceedingly difficult to obtain anything like an approximate idea of the quantity of refuse, fluid or solid, which is turned into the rivers, not a manufacturer, millowner, or dyer appearing to have any notion whatever of the weight or quantity of refuse sent out from his premises ; but a very evident desire has been shown by a great majority to afford information, and only in one or two instances has it been withheld, and in such cases by parties who are the worst pollutors of the streams. I find in many cases that the quantity of dye liquor sent out from single dyeworks amounts to 1,000,000 gallons per annum. The town of Huddersfield, within the limits of the Improvement Act, a distance of 1,200 yards from the centre of the market-place, all drains into the river Colne. There is no regular system of sewerage, and at present the sewage is discharged into the river at five different outlets. Another large sewer is about to be constructed in the Hebble Valley, which, when completed, will make a sixth outlet. The population within the limits is 23,379, occupying 4,461 houses, averaging nearly 5¼ per house. There are a great number of waterclosets, the contents of which of course find their way into the river ; and it is the opinion of

many that the mill dams on the stream below Huddersfield are the receptacles for the contents of those waterclosets, in consequence of which the dreadful stench caused by the fermentation of the mud in hot weather is almost unbearable. No system of ventilation has yet been put into execution, and great complaints are made by the inhabitants residing in the upper part of the town about the want of ventilation.

3125*. You mean in the sewers?—Yes. The amount expended in the construction of sewers from the adoption of the Act in 1848 is 8,281*l.* It would not be difficult to intercept the several outfalls, and carry the whole of the sewage of the town beyond its limits; and I do not think it would require a greater sum than 5,000*l.* Of course that is merely a rough estimate. The number of mills, manufactories, dyeworks, and chemical works on the streams amount to 211. The number of townships comprising the water shed amount to 33, and I have prepared a tabulated statement of the population, area, and rateable value of each. Most of the villages on the banks of the stream drain directly or indirectly into the river, as generally speaking the fall is such as to carry the sewage very quickly into the stream, before it has the opportunity of percolating through the soil into the ground. Paddock, on the banks of the Colne, has laid down a system of pot-pipe drainage; and Lockwood proper, with a population of about 5,000, has during the last year completed a system of sewerage into the Holme, at a cost of about 2,500*l.*; and Berry Brow, on the same stream, with a population of about 2,000, has also a system of drainage into the Holme. There are several other populous villages on the rivers which have not laid down any special system, but which nevertheless drain into the rivers, viz., Mold Green, Milnesbridge, Slaithwaite, Golcar, Marsden-on-the-Colne, Honley, Thongsbridge, Holmfirth, and Holme-on-the-Holme, as well as many other small hamlets which may be better observed by reference to the map. There are about 18 miles of roads and streets, paved, macadamised, within the area of the Huddersfield Improvement Act, including those not paved, of which there are three miles.

3126*. Are you surveyor of turnpike roads?—I am.

3127*. Do any surveyors of highways tip road scrapings into streams when it is convenient?—In many instances they do.

3128*. Do they do so in Lockwood?—To a very considerable extent.

3129*. (*Mr. Harrison.*) Are the manufactories mentioned in your table the whole of the manufactories within that area?—All that are immediately upon the banks of the stream. There are others away from the stream; in Huddersfield, for instance, there are manufacturers who carry on their business, but their refuse water is turned down the public sewers.

3130*. Still it finds its way into the river?—Yes.

3131*. To make the information complete I think that we ought to have those particulars if possible?—You shall have them.

3132*. You have mentioned Messrs. Hardy and Armitage and Kenyon's works?—I have.

3133*. Did you observe the water as it came off the irrigated land?—As it was put on I noticed it.

3134*. But not as it came off?—No; there was no opportunity of seeing that.

3135*. Why not?—Because there was no particular place where the water left the irrigated land.

3136*. There was no drain which collected the water?—No.

3137*. (*Chairman*) It was absorbed?—Yes.

3138*. If it came out at all it came out in springs?—Yes.

3139*. (*Mr. Harrison.*) If there were mills below those works dependent upon water power, might not the owners of those mills object to the application of the water to the land in that way?—Do you mean in consequence of the loss of water?

3140*. Yes?—No; because the water which they use for dyeing is spring water, which they collect upon their own properties, and which has not been in any way taken out of the stream.

3141*. Had you not any opportunity of seeing whether the water was purified by passing over the land?—I had not. The water as it was pumped upon the land was about the colour of ink; the crops of grass grown were very good indeed; and Mr. Kenyon is prepared to come here and give evidence to prove the success of this irrigation scheme.

3142*. (*Professor Way.*) If you heard that the overflowing of the Calder containing these dye refuses had injured land, and did not do so 20 years ago, you would hardly refer the difference to the dye stuffs?—I think that it is just possible that refuse from the dyeworks alone might be injurious to the land.

3143*. I speak of the river Calder. We had evidence given us at Dewsbury that the overflowing of the river of late years has been injurious to the land in places where the river used to overflow without any objectionable influence; would you refer that to the dyeing?—I should imagine that it would be attributable to the dyeworks.

3144*. Still you say that with these very causes the refuse has been poured on to the land with great advantage to the land?—The dye refuse and the soap combined. I do not consider that any good is done to the land by the dye liquor; but the land takes the good and the bad together.

3145*. If there is any injurious effect from the dyewoods upon the grass the action of the soap would not prevent that injurious effect, would it?—That is more a question for a chemist.

3146. But the crops were not only not injured, but were greatly benefited?—Yes.

3147*. (*Mr. Harrison.*) Are the soapsuds throughout this district generally collected and utilized by Mr. Teall's process?—I believe that they are in most of the mills and works.

3148*. Have the returns which you have given us been submitted to the different manufacturers for correction?—These returns are compiled from forms which I have sent out to each manufacturer to fill up in his own way.

3149*. So that they are their own returns?—Just so.

3150*. Several of the villages which you have mentioned have carried out systems of sewerage?—Yes, into the river.

3151*. From your knowledge of the district is there generally convenience adjoining those villages for sewage irrigation?—I think not.

3152*. (*Chairman.*) You would have no such convenience in Lockwood?—No.

3153*. Nor in Newsome?—No.

3154*. It must be below if it can be anywhere?—Yes.

3155*. (*Mr. Harrison.*) Below Huddersfield is there any extent of land suitable for irrigation, I mean between Huddersfield and the Calder?—The land in that neighbourhood is very valuable; it is possible that land might be found, but not to a very great extent.

3156*. Then do you think that the sewage of the whole district cannot be easily applied to the land without pumping to the higher levels?—I think not.

3157*. (*Professor Way*). Would the fact of the land being valuable preclude its being made more valuable by sewage?—It is just possible that the land in that neighbourhood may be required for building and mill purposes.

3158*. If the land is valuable for agricultural purposes is there any objection to its being made more valuable for such purposes?—Certainly not.

3159*. (*Mr. Harrison.*) Can you, throughout the return which you have given us, dot down the source of the water supply for each of those mills?—Do you mean the private supply?

3160*. Yes, whether it is from reservoirs erected by water companies, or from the canal, or from water upon the land?—I can do so certainly.

3161*. (*Professor Way.*) You are not responsible for these returns?—No; in most cases the dimensions

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have been taken by me in the presence of the millowners.

3162*. The printed returns have been filled up by the manufacturers themselves?—Yes, or in their presence.

3163*. (*Chairman.*) Are you surveyor to certain turnpike trusts?—Yes.

3164*. Do those roads for any considerable length drain towards and into the streams of the district?—Some of them do at different places, but it would be very difficult for me to state the extent.

3165*. Is regular and constant attention to those roads, so as to keep them in order, the truest economy?—Yes, there is no doubt of it.

3166*. If you take off the mud as it is formed and water the roads when they are dusty, have you not less material to flow off in the shape of mud, and you get the road in a better condition?—You do.

3167*. And it lasts longer?—It does.

3168*. With respect to the sewerage which has been laid out by the Commissioners, has it been entirely laid out upon principles of your own, or did you find a system of sewers laid down when you came into office?—There is no general system of sewerage; it has all been done piecemeal.

3169*. Are your sewers at present ventilated upon any principle?—No.

3170*. Do you know whether the parties living in the higher districts of the town have at any time suffered inconvenience from foul gases getting back again into their houses?—Constant complaints have been made from the upper parts of the town on account of these bad smells.

3171*. Have you been called upon in any instance to attempt to remedy that state of things, I mean in the drains of any separate houses?—Yes.

3172*. By what means have you attempted to overcome the nuisance?—Simply by disconnecting the sink pipe from the drain outside, so that the air might take away any bad smell which came up the pipe and would necessarily have gone into the building. I have always been of opinion that there should be manholes, and more frequently. At the present time we have no opportunity of inspecting a drain except by means of some very indifferent manholes which we have, and which are generally covered up with stones about six inches thick.

3173*. And then you must break the road and raise the flag?—We must break the road and raise the flag, and there is a great deal of unnecessary labour which might be economised.

3174*. Have you prepared a plan showing the sewerage which would be required for the township or the whole of the area?—I have not.

3175*. Are there many private streets not yet sewered?—Yes, many.

3176*. And many houses which are not drained?—Yes, a good many. There are some cesspools in the town, but I believe not very many.

3177*. (*Mr. Harrison.*) As to the returns, you have stated that they are the returns from the manufacturers?—Yes, they are their returns. What passed in each case was something of this kind: a mill owner would say to me, "I have three pans here, "and these pans I discharge once a day, you can "take the dimensions of them and work out your own "calculation," and that is the only thing which I have done.

3178*. (*Chairman.*) If they fill and empty those pans more or less frequently than you have been led to believe you are not responsible for that?—I am not.

3179*. And the number of times of filling and emptying will vary?—Yes. I do not think it is possible for any millowner to tell the exact number of times which he fills these pans in a year.

3180*. (*Professor Way.*) I had an impression that you had sent out a printed paper to be filled in?—That is so; this paper is exactly as it has been filled up by the millowners, with the exception of the figures in pencil. All that I am responsible for is for the measurement of the pans and for the calculation of the quantity of water sent out from those pans, made from data sent me by the manufacturers as to how many pans were used and how often they were discharged.

3181*. They gave you that verbally?—Certainly.

3182*. Did you take notes of the figures, or did you calculate them on the spot?—I could not well calculate them on the spot, I calculated them in my office afterwards.

3183*. (*Mr. Harrison.*) Are the labouring classes in Huddersfield supplied from the waterworks?—They are; of course that is a general supply for the town.

3184*. (*Chairman.*) Is the new sewer of which you have been speaking intended to drain the district which Mr. Brook, the registrar, mentioned as producing the greatest mortality?—It is for the purpose of draining the northern part of Huddersfield which lies in the Hebble Valley. Birkby is beyond the limits of the Huddersfield Improvement Act. At the present time the stream is polluted by owners and occupiers of houses and mill property above in the neighbourhood of Birkby and Lindley to such an extent that the Commissioners thought that they were justified in putting down this sewer, to intercept foul water from going into that part of its course which lies within their own limited jurisdiction, and that then they would have a perfect right to say to the owners of property above, "You must take out yours also in order to purify the stream."

3185*. If in the case of the out-townships the fall of the land is in or through Huddersfield, do you think that there would be any difficulty in treating with the Commissioners for an outfall for their sewers?—Not any. I take it that the sewer has been put down with an express understanding on the part of the Commissioners that by an arrangement the whole of the district coloured pink, which is beyond their district, should be drained into that sewer.

3186*. What fall will your sewer have?—At the rate of 69 feet per mile.

3187*. That of course is a fall which will send a rapid current through the sewers, and if properly arranged you do not anticipate that much dirt will accumulate?—Not any, if the pipes are properly laid.

3188*. (*Mr. Harrison.*) Have you heard the evidence this morning as to the purity of the Colne in former years, and as to its condition at present?—Yes.

3189*. Do you consider that the impurity of the stream has injuriously affected the poor of the town of Huddersfield?—It has affected them in this respect, the millowners have fouled the stream which was the natural supply of the district. The water, I believe, was used originally by many people for culinary purposes; and while the millowners have taken away this natural water supply from these streams, they have not of themselves provided an artificial supply for those poor inhabitants, but those inhabitants have had to pay water rents for the water supply which has been issued artificially in lieu of the one taken away from them by the millowners.

3190*. And that artificial water supply on some occasions is insufficient?—It is very limited, I believe.

3191*. (*Chairman.*) Is it a fact that rivers are ever to any very great extent used by the inhabitants upon their banks?—I think that they were originally.

3192*. Do you not think that people would take the springs and wells in preference?—I feel quite sure that the people on the rivers formerly used the water repeatedly for culinary purposes, the small farmers invariably used the water for their cattle to drink, and they cannot do so now at all. Now, when a small farmer has his supply from the town he has to pay a water rent which previously he had not to do.

3193*. (*Mr. Harrison.*) Then that is one fair argument among others for the prevention of the pollution of the Colne?—I think so.

3194*. (*Professor Way.*) Is it the case generally that cattle cannot drink the water?—They cannot drink it.

3195*. Or the water of any of these streams?—In

the out districts towards the sources of course they can, but anywhere within a mile of Huddersfield it is impossible.

3196*. (*Chairman.*) What is your opinion as to the bed of the river Holme?—I remember very well, when I was quite a boy, seeing people repeatedly bathe in that river, and I have seen two or three very narrow escapes from drowning on account of the depth of water.

3197*. At what point ?—Near to the Dungeon Mill, belonging to Mr. Wrigley. A man would now have very considerable difficulty in finding sufficient water to come up to his knees, and where it used to be a nice sandy bottom it is mud.

3198*. You attribute that to the solid matter thrown in from above ?—Yes.

3199*. Are you aware of what becomes of the scrapings from the different roads of the district, or any portion of them abutting on the river ?—When the scrapings have not been suitable for plasterers or for sand, or anything of that sort, they have found their way into the river. I am myself in a great measure responsible for that, because it is the cheapest way of getting rid of them, and I have naturally tried to get rid of them as economically as possible.

3200*. And you have had them taken into the stream ?—I have.

3201*. Have the men under your charge carefully tipped the road scrapings on to the margin of the stream ?—They have until lately ; they are not doing it now. I have put a stop to it ; that applies to such roads as I am the surveyor of. On many of the highways it is the custom to put the road scrapings into the river, because the peculiar kind of material which is used for road making in those localities is not suitable for plasterers after it is scraped off. Where free sandstone is used the scraping from the road is used by plasterers ; but where we use dross, and material of that kind, it is not so much sought after by plasterers.

3202*. Then the highway surveyors as well as yourself use the nearest stream or watercourse as a tip ?—That has been too much the case, I believe.

3203*. Do you think that the bed of the river has generally risen of late years ?—I know that it has of late years, all the way from the mill of Mr. Wrigley at Dungeon to the confluence of the Colne. I should think that the whole of that portion of the river during the last 20 years has been raised two feet.

3204*. Has such rise of the bed in any instances caused flooding to mill property and adjoining land ?—Yes, Mr. Brook gave evidence this morning as to Folly Hall Mill ; the lower floor of that mill will very soon be untenable if the river continues to rise as it has done in the last five or six years. Then there is Mr. Beaumont Taylor, who has a log-wood grinding mill on the river Holme in the township of Lockwood ; he some years ago suffered very considerable damage from the increased level of the river, and the increased level of the water was accounted for by the increased elevation of the river's bed. His place was flooded something like two feet ; if the river's bed had kept to its original level those two feet of water would have kept out of his mill.

3205*. Do dyeware principally discolour the river water?—Yes.

3206*. If they were taken out it would be comparatively clear ?—It would.

3207*. (*Mr. Harrison.*) You have said that a great deal of the refuse from the roads has hitherto been put into the river ; do you think that it would be a proper thing if that practice were to be stopped summarily ?—Yes, I think that it is very proper that it should be stopped.

3208*. (*Chairman.*) There are scores of miles of highways in the county of Yorkshire where the refuse scrapings from the roads must be dealt with otherwise than by being thrown into the streams, because no stream is near ?—Quite so ; and in this neighbourhood I think that there are acres of land which might be very much improved by being raised to a higher level, I mean improved for drainage and building purposes.

3209*. (*Mr. Harrison.*) From your knowledge is the refuse of the roads useful for agricultural purposes ?—Not so much for agricultural purposes.

3210*. Do you think that road scrapings or slag are not useful upon grass land ?—A great quantity of slag is used here which it would not be at all advisable to put on to land.

The witness withdrew.

REPORT (referred to supra, Question 3119*) of Mr. JOHN H. ABBEY, Surveyor to the Commissioners of the Huddersfield District.

RIVER COLNE.

Name of Mill, &c.	Owner or Occupier.	Description of Work.	No. of Hands.	Description of power used. Water or Steam.	What Reservoir Room.	Description of Refuse turned into Stream.	Quantity of Solid.	Quantity of Liquid.	Remarks.
Colne Bridge Mills	Thomas Haigh & Sons	- - -	-	- - -	- - -	None - - -	None - -	None.	
Woodhouse Mills	George Benton	Dyeing - - -	3	Water and steam	- - -	Dye water - - -	- - -	7,200 gallons a week.	
Do.	Joseph Hoyle & Son	Cloth finishing - -	38	Do.	0a. 2r. 0p.	Washing off water. ashes, and mud from reservoir.	Ashes from 2,000 tons of coal per year and 1,613cubic yards of mud once in two years.	16,800 gallons a week.	
Do.	Geo. Hopkinson & Son and others.	Woollen manufacture -	120				—		
Bradley Mills	James Brooke & Sons	Woollen manufacture -	200	Do. -	- - -	Dye and scouring liquor	- - -	6,752 gallons a week.	
Do.	Chas. Atkinson & Co.	Milling and finishing -	50	Do. -	None but Forebay -	Dye liquor, soke, and ashes	- - -	2,587 gallons a week.	
Do.	E. and C. Eastwood	Woollen and cotton dyeing -	20	Do. -	337,500 gallons -	Dye refuse and ashes -	13,000 cubic feet of mud in 14 years.	4,806 gallons a week.	
Do.	Sykes, Hale & Bell	Spinning - - -	150	Do. -	Forebay36,450 gallons	None - - -	None - -	None - -	
Grove Dyeworks	John Pollard	Cotton dyeing - -	12	Steam -	None - -	Dye liquor and ashes -	Two loads a week -	25,200 gallons a week.	
Tanfield Mills	William Learoyd & Sons	Woollen manufacture -	250	Do. -	91,125 gallons -	Dye liquor - - -	- - -	225,000 gallons a week.	
Town Lane Mill	Jas. Learoyd & Sons	Do. and yarns -	250	Do. -	22,443 gallons -	Scour water, ashes, suds, and refuse from waterclosets.	100 tons a years. —	—	
Canal Bridge Mills	Ramsden, Learoyd, & Holroyd	Woollen manufacture -	-	Do. -	None - -	Dye liquor and ashes.	—	—	
Prospect Dyeworks	Heppenstall, Brothers	Woollen and cotton dyeing -	31	Do.	108 square yards -	Dye liquor - -	—	—	
Chemical Works	Read Holliday	Chemicals - - -	-	Do. -	- - -	None - - -	—	—	
Turn Bridge Dyeworks	Benjn. & John Hey	Woollen and woollen dyeing	16	Steam -	None - -	Dye water - - -	- - -	28,086 gallons a week.	
Redhill Dyeworks	John Burgess & Son	Dyeing and bleaching -	75	Do. -	None - -	Shumac, logwood, lime, chloride of lime & sulphuric acid.	366 tons a year -	104 gallons a week.	
Aspley Dyeworks	Greenwood Brothers	Woollen dyeing - -	12	Water -	None - -	Dye liquor and ashes -	- - -	5,700 gallons a week.	
Aspley Print Works	Dewhirst Brothers	Calico printing - -	-	- - -	- - -	None.	—	—	
King's Mills	William C. North	Woollen yarn spinning -	100	Water and steam	None - -	None.	—	—	
Do.	Brierley & Co.	Flax - - -	-	- - -	- - -	None.	—	—	
Colne Road Foundry	Henry Brook	Castings - - -	30	Steam - -	None - -	Ashes.	—	—	
Colne Road Dyeworks	William Hudson	Wool dyeing - -	12	Do. - -	None - -	Dye water.	- - -	31,824 gallons a week.	
Britannia Mill	Joseph Hopkinson	Cotton and woollen manufacture.	400	Do. - -	None - -	Scouring water - -	- - -	4,308 gallons a week.	
Engine Bridge Mill and dyeworks.	Edmund Eastwood	Woollen manufacture and dyeing.	120	Water and steam	None - -	Dye and scour refuse and ashes.	Ashes from 1800 tons of coal a year.	750,000 gallons a week.	
Engine Bridge Finishing Works.	Haigh Brothers	Cloth finishing - - -	8	Steam - -	None - -	Ashes - - -	Ashes from 3 tons coal per week.	—	
Folly Hall Mills	Joseph Kayes' exors.	Carding and cloth finishing	420	Do. - -	219,375 gallons -	Ashes and dye water -	Ashes 380 tons a year and 435 cubic feet of mud.	169,938 gallons a week.	
Isthmus Mills	Saml. Hiley & Son	Cloth finishing - -	20	Steam -	None - -	Washing water and a few ashes	—	—	
Upperhead	Lockwood & Keighley	Woollen card manufacture -	200	Do. - -	630,000 gallons -	None.	—	—	
Longroyd Mills	Starkey Brothers	Woollen manufacture -	600to700	Do. - -	750 square yards -	Dye water.	—	—	
Birk House Lane Dyehouse	Joseph Walker & Sons	Wool dyeing - -	14	Do. - -	None - -	Dye and washing water and ashes.	- - -	24,000 gallons a week.	
Pedley Mills	W. & H. Crosland & others	Manufacturing and dyeing -	56	Do. - -	0a. 1r. 0p.	Dye and scour water.	—	—	
Mill Gate	John & Joel Crowther	Cloth finishing - -	28	Do. - -	Water from Jas. Crosland's reservoir	Washing water.	—	—	
Paddock Mills	Jas. Crosland & Son	Woollen manufacture -	120	Water and steam	0a. 2r. 0p.	Dye and scour water and ashes.	- - -	13,572 gallons a week.	
Longroyd Mills	Edwd. Fisher & Co.	Silk spinning - -	300	Do. -	None - -	Water from boiler-house.	—	—	
Crosland Moor Mills	Geo. Crosland & Sons	Woollen manufacture -	340	Steam - -	800 square yards -	Dye and scour water.	—	—	
Mark Bottoms Mill	Tyne Crosland	Cloth finishing - -	30	Do. - -	None - -	Washing water.	—	—	

1715.—2.

Name of Mill, &c.	Owner or Occupier.	Description of Work.	No. of Hands.	Description of Power used Water or Steam.	What Reservoir Room.	Description of Refuse turned into Stream.	Quantity of Solid.	Quantity of Liquid.	Remarks.
Mark Bottoms Mill	John Firth, Sons, & Co.	Woollen manufacture	200	Steam	None	Dye and scour water, ashes and excavations.	—	—	
Lower Bank House Spring Mill. Upper Bank House	Armitage Brothers	Manufacturing dyeing and logwood grinding.	290	Water and steam	1a. 2r. 0p.	Dye and scour water and bark	—	—	
Union Mill	Joseph Dyson	Woollen manufacture	105	Steam	None	Dye and scour water	—	—	
Bank House Mill	Robert Beaumont	Woollen scribbler	18	Water	0a. 2r. 0p.	Dye water	—	200 gallons a week.	
Quarmby Mill	Thomas Hirst & Sons	Woollen manufacture	30	Water and steam	None	Do.	—	300 gallons a week.	
Milnsbridge Tannery	Chas. Denham	Leather tanning	30	No power	None	Water after cleaning hides	—	750 gallons a week.	
Bottom Hall Hill	Shaw & Taylor	Woollen and cotton	11	Water	340,312 gallons	None	—	—	
Spring Gate Dye and Chemical Works.	Dawson Brothers and D. Dawson.	Wool dyeing and dyers' chemicals.	8	Steam	154,862 gallons	Dye liquor and ashes	From 9 tons coal per week. 76 cubic yards mud in four years.	—	
Holm Vale Dyeworks	Haigh & Heaton	Cotton and woollen dyeing	20	Steam	None	Spent dye liquor and ashes	From 20 tons of coal per week.	96,000 gallons a week.	
Colne Vale Mills	Jas. Mellor & Son	Woollen manufacture	172	Steam	None	Dye and scour water and ashes.	From 27 tons of coal per week.	861 gallons per week.	
Britannia Mill	Shaw & Shaw	Cotton spinning	—	Water and steam	Nothing but grit	—	—	—	
Ramsden Mill	Ramsden & Son	Woollen manufacture	70	Do.	227,812 gallons	Dye and scour water and ashes from 25 tons of coal per week.	1350 cubic yards mud in two or three years.	—	
Ramsden Mill	Ramsden Mill Co.	Do.	50	Water and steam	Do.	Dye and scour water and ashes from two or three tons coal per week.	—	—	
Lowwestwood Lower Mill	Thomas Shaw	Do.	200	Do.	0a. 1r. 0p.	Soke.	—	—	
Do. Upper Mill	David & Chas. Shaw	Do.	40	Do.	0a. 2r. 0p.	Dye and scour water	5,196 cubic yds. a year	—	
Lees Mill	Shaw & Bray	Do.	50	Water	918,843 gallons	Do.	1,800 cubic yds. a year	—	
Albion Mill	Joe. Harrison & Co.	Do.	50	Steam	78,500 gallons	Dye water	1,000 gallons a week.	—	
Do.	Geo. Mallinson & Sons	Do.	—	Do.	275,350 gallons	—	—	—	
Victoria Mill	Ainley & Taylor & others	Woollen scribbling	120	Do.	791,759 gallons	Dye water	—	2,868 gallons a week.	
Heath House Mill	John & Richard Ainley	Woollen manufacture	15	Do.	25,312 gallons	Dye and scour water	—	800 gallons a week.	
Brook Mill	George Haigh	Do.	58	Do.	143,948 gallons	None	—	—	
Spa Mill and Clough House Mill.	John & Saml. Horsfall	Do.	50	Do.	4,050 gallons	Filtered water from stocks.	—	—	
Water Side Mill and Shaw Carr Mill.	J. S. Scholes' exors.	Cotton spinning	90	Water and steam	4,498,125 gallons	Mud	26,620 cubic yards once in two years.	—	
Do.	John Farrar	Scribbling and spinning	40	Do.	68,850 gallons	Dye water.	—	—	
Upper Mill	Exors. of J. & W. Haigh	Woollen manufacture	40	Water	1,633,500 gallons	Scouring water.	—	—	
Mellor's Dyeworks	John Mellor	Wool and cotton dyeing	5	Steam	7,500 gallons	Dye water	—	3,600 gallons a week.	
Kiln Hill	Meal & Quarmby	Cotton dyeing	24	Do.	791,750 gallons	Do. and acids, &c.	100 tons a year	86 gallons a week, acids and ammonia.	
Crumble Mill	Hy. Hopkinson	Woollen manfuacture	40	Do.	None	Dye and scour water	—	3,834 gallons a week.	
Slaithwaite	Crowther & Sons	Scribbling and weaving	60	Water	1a. 0r. 0p.	Dye water and mud from dam two or three times a year	—	—	
Marsden	Do.	Scribbling and woollen	10	Do.	0a. 2r. 14p.	Do. do.	—	—	
Cellars Clough	Dowse & Collins	Cotton spinning & doubling	150	Water and steam	Between 3 and 4 acres	Mud from dam and excavations	—	—	
Wood Bottom Mill	Hirst, Stockwell, & Hirst	Woollen manufacture	33	Water	4,000 gallons	Dye and scour water	180 cubic yds. a year	1,270 gallons a week.	
Upper End Mill	John & J. Farrar	Scribbling and fulling	18	Do.	151,875 gallons	Do. and ashes	900 do. in four years	309 gallons a week.	
New Mill	Saml. Bowers' exors.	—	—	—	—	—	—	—	Standing.

REPORT of Mr. JOHN H. ABBEY.—RIVER COLNE—*continued.*

Name of Mill, &c.	Owner or Occupier.	Description of Work.	No. of Hands.	Description of Power used. Water or Steam.	What Reservoir Room.	Description of refuse turned into Stream.	Quantity of Solid.	Quantity of Liquid.	Remarks.
Clough Lee Mill	Robinson Brothers	Manufacture	100	Water and steam	0a. 2r. 0p.	Scour water and mud from reservoir.	—	—	
Fall Lane Mill	Hirst & Company	Woollen manufacturer	15	Water	791,750 gallons	Dye and scour water	—	3,450 gallons a week.	
Marsden Mills	Benjn. Sykes & Sons	Do.	200	Water and steam	1,361,137 gallons	Do.	4033 cubic yards in six years.	—	
Canal Mills	John Sykes & Sons	Machine making & woollen manufacture.	400	Steam	None	None.	—	—	
Chapel Hill Mills	William Hy. Charlesworth	Card making, yarn spinning, and machine making.	90	Do.	14,850 gallons	None.	—	—	
LEES BECK.									
Lees Mill	Battye Brothers	Yarn manufacture	27	Water and steam	—	None.	—	—	
Seniors Mill	Jas. Wild & Co.	Woollen manufacture	60	Steam	—	Soapsuds and dye liquor.	—	—	
Mill Hill	Tolson Brothers	Fancy do.	—	Do.	530,985 gallons	Do.	—	—	
West Field Dyeworks	Isaac Robson & Sons	Cotton dyeing	32	Do.	1,300,000 gallons	Dye water.	—	—	
Do. Silk Mill	George Wilson	Silk spinning	80	Do.	—	Do. and suds.	—	—	
Do.	John Pollard	Chemicals, &c.	1	—	339,862 gallons	—	—	—	
Spa Bottom Mill	Abrm. Brierley	Carding, spinning, and manufacture	160	Steam	—	Scouring water.	—	—	
Fenay Mill	Riley Brothers	Fancy woollens	100	Steam	1a. 1r. 0p.	Soap and dye woods.	—	—	
Woodsome Lees Chemical Works	Herbert Sugden	Chemicals	2	—	22,443 gallons	Water from still	—	4,556 gallons a week.	
Dogley Mill	J. & T. Kenyon	Woollen manufacture	130	Water and steam	—	Dye water	—	20,880 gallons do.	
Valley Dyeworks	Lockwood & Mallinson	Cotton and woollen dyeing	20	Steam	118,800 gallons	Do.			
Dean Mill	Hermann Geissler	Woollen manufacture	120	Do.	712 sq. yds.	Do. and soapsuds	—	—	
Shepley New Mill	Barnicott & Kenyon	Do.	200	Do.	7,050 sq. yds.	None.	—	—	
Victoria Mill	W. & E. Armitage	Do.	194	Do.	2,450,250 gallons	None.	—	—	
Whitley House	William Peace	Fancy vestings	6	Do.	3,781 gallons	—	—	—	
Cliffe Mill	John Goldthorp	Woollen manufacture	6	Do.	—	Condensed water.	—	—	
Brook House Mill	J. & J. Child	Do.	150	Do.	465,750 gallons	Dye liquor.	—	—	
Do.	George Hey	Manufacture and dyeing	100	Do.	0a. 2r. 0p.	Soap suds and dye water and mud from reservoir.	—	—	
PENNY DIKE.									
Mold Green Chemical Works	Anthony K. Kaye	Chemicals and gas	12	Steam	101,250 gallons	Washings from bowls.	—	—	
Rookery Mill	Geo. Gelder	Woollen yarn spinning	30	Do.	440 square yards	Dye wares.	—	—	
Rookery Mill and Aspley Mill	Tolson Haigh, & Brooke	Do. and manufacturing	180	Do.	33,750 gallons	None.	—	—	
Do.	John Day & Sons	Do.	400	Do.	749,925 gallons	Dye water.	—	—	
Mold Green Dyeworks	William Shaw	Bleaching and cotton dyeing	9	Do.	60,750 gallons	Spent dye liquor and mud	34 cubic yds. a year.	—	
Kidd Royd	John Marsden	Cloth finishing	8	Do.	3,375 gallons	Washing off water and mud	3 cubic yds. a year.	—	
Town End Dyeworks	Joshua Shaw	Cotton dyeing	5	Do.	101,250 gallons	Dye water	—	7,000 gallons a week.	
North Field Mill	J. E. Taylor, Brothers	Woollen and shawl manufacture	200	Do.	300 square yards	Do.	—	—	

HEBBLE BECK.

Name of Mill, &c.	Owner or Occupier.	Description of Work.	No. of Hands.	Description of Power used. Water or Steam.	What Reservoir Room.	Description of refuse turned into Stream.	Quantity of Solid.	Quantity of Liquid.	Remarks.
Willow Lane Dyeworks	William Brigg & Co.	Wool and cotton dyeing	6	Steam	27,000 gallons	Dye water	—	200 gallons a week.	
Bay Hall Dyeworks	John Brown	Bleaching, dyeing, and finishing	37	Do.	5,750 gallons	Spent dye liquor, bleaching liquor, and cloride of lime	72 cubic yds. of mud per year	4,308 gallons a week.	
Bay Hall Mill	Stork Brothers	Angola, yarn, and spinning	150	Do.	100 square yards	Dye and scour water.	—	—	
Clough House Mill	George Scholes	Do.	60	Do.	0a. 2r. 0p.	Scour water.	—	—	
Stone Mill	Benjn. Holroyd	Manufacture	—	—	—	None.	—	—	
Acre Mill	Joseph Sykes & Bros.	Do.	—	—	—	None.	—	—	
Temple St. Mill	John Crosland	Do.	—	—	—	None.	—	—	
Plover Mills	Joseph Walker & Sons	Do.	350	Steam	3,600 yards	Gig water, almost clean.	—	—	
Wellington Mills	Liddell & Martin	Do.	250	Do.	4,840 yards	Dye water and washing water.	—	—	

LONGWOOD BROOK.

Longwood Gasworks	Longwood Gas Co.	Gas making	3	—	Gas holder 250,000 gallons	Water from gas holder.	—	—	
Cliffe End Mill	Greenwood, Hanson & Co.	Woollen manufacture	230	Steam	5,562,500 gallons	Dye water	—	18,000 gallons a week.	
Quarmby Clough Mill	Geo. Hattersley & Sons	Do.	80	Do.	0a. 0r. 16p.	Dye and scour water.	—	—	
Quarmby Mill	Abrm. Hall	Do.	40	Do.	400 yards	Condensed water.	—	—	
Hirst Mill	Do.	Do.	30	Water and steam	0a. 3r. 0p.	Dye and scour water.	—	—	
Oakes Mill	Benjamin Crosland	Do.	90	Steam	4,050,000 gallons	Do. do.	—	—	
Grove Mill	William Shaw & Sons	Do.	—	Water and steam	0a, 1r. 0p.	Oil and dye wares, &c.	—	—	
Clough Mill	Fisher & Son & others	Do.	—	Do.	5,000 square yards	Dye and soap water.	—	—	
New Mill	John Broadbent & Son	Do.	300	Do.	5,000 gallons	Do. do.	—	—	
Lane Field End Dyeworks	William Beaumont	Wool dyeing	5	Steam	101,250 gallons	Dye water	—	4,500 gallons a week.	

RIVER HOLME.

Junction Mill	John J. Rhodes	Cloth finishing.	—	—	—	—	—	—	
Hope Foundry	Joseph Shires	Castings.	—	—	—	—	—	—	
Rashcliffe Iron Works	George Kirk	Machine making	—	—	—	—	—	—	
Rashcliffe Mill	Messrs. Blamires	Woollen manufacture	50	Steam	None	Dye water, scour water & ashes	—	126,522 gallons a week.	
Logwood Mill	Hy. B. Taylor	Drysalter	—	—	—	—	—	—	
Victoria Mill	John W. & Hy. Shaw	Woollen manufacture	110	Steam	None	—	—	—	
Albert Mills	Berry & Turner	Do.	200	Do.	None	Dye and scour water	—	201,879 gallons a week.	
Bath Mills	Roberts, Sons & Nephew	Do.	150	Do.	None	Scour water	—	33,300 gallons a week.	
Baths	William Wood	—	—	—	—	Ashes	50 tons a year.	—	
Broadfield Mills	Hy. Crowther & Sons	Woollen manufacture	671	Steam	—	Ashes, dye wares, & dye water	420 tons a year.	—	
Do.	Hy. Hirst & Sons	—	—	—	—	—	—	—	
Lockwood Mill	Geo. Crosland & Sons	Manufacture and gas making	180	Steam and water	0a. 3r. 0p.	Scour water and mud	50 cubic yards once in 10 years.	—	
Newsome Mills	Taylor & Lodge	Do.	70	Steam	675,000 gallons	Suds and lime water	—	861 gallons a week.	
Dungeon Mills	J. & T. C. Wrigley	Do.	230	Steam and water	1a. 0r. 0p.	Dye water, dye wares, ashes, and soke.	—	—	
Taylor Hill Mills	Benjn. Vickerman & Sons	Do.	152	Steam	—	Dye water and soap washings	—	—	
Armitage Bridge Mills	John Brooke & Sons	Do.	540	Steam and water	—	Ashes, dye liquor and soke	—	1,525,920 gallons a week.	

REPORT of Mr. JOHN H. ABBEY.—RIVER HOLME—*continued.*

Name of Mill, &c.	Owner or Occupier.	Description of Work.	No. of Hands.	Description of Power used. Water or Steam.	What Reservoir Room.	Description of Refuse turned into Stream.	Quantity of solid.	Quantity of Liquid.	Remarks.
Steps Mill	Beaumont & Vickerman	Manufacture and gas making	240	Steam and water	2a. 2r. 0p.	Refuse from scouring and dyeing wool and from gas works, and ashes.	1 ton of ashes a day	1,480 gallons a week.	
Reins Mill	Benjn. Mellor & Son	Do.	120	Steam	—	—	—	—	
Neiley Mill	James Shaw	Yarns, spinning, and dyeing	200	Do.	0a. 1r. 0p.	Soapsuds and dye wares.	—	—	
Do.	George Scott	Woollen manufacture	24	Do.					
Smithy Place Mill	James Robinson	Do. and dyeing	150	Steam and water	0a. 2r. 0p.	Washing water and dye liquor	—	14,322 gallons a week.	
Banks Mill	John Haigh & Co.	Scribbling, spinning, & milling	14	Water	4,840 square yards	Washing off water.	—	—	
Rock Mills	John H. Bower	Cotton spinning	100	Steam	—	None.	—	—	
Do.	Beaumont & France	Woollen manufacture	40	Steam and water	272,193 gallons	None.	—	—	
Mytholm Bridge Mill	Joseph Mellor	Do. and dyeing	70	Do.	284,681 gallons	Dye liquor, scouring water and excavations	—	19,050 gallons a week.	
Alma Mills	Joseph Mellor & Sons	Woollen manufacture	120	Steam	0a. 1r. 0p.	Dye and scour water and mud	300 cubic yards per month	—	
Thongsbridge Mills	Thomas Mellor & Sons	Do.	160	Steam and water	1a. 1r. 0p.	Do.	—	—	
Bridge Mills	Joseph Turner & Sons	Do.	160	Do.	1,429,312 gallons	Do.	—	8,267 gallons a week.	
Holmfirth Mills	Jonathan Thorpe	Do.	88	Do.	500 square yards	Dye water, scouring water, mud from dam, sewage, and ashes	2 tons of ashes per year	—	
Underbank Mill	Geo. Thewlis & Sons	Do.	—	Steam	0a. 0r. 30p.	None.	—	—	
Lower Mill	John Bower & Sons	Woollen manufacture	80	Steam and water	0a. 2r. 0p.	Sweepings from mill and mud from Reservoir.	—	—	
Prickleden Mill	James Holmes & Sons	Do.	100	Do.	0a. 2r. 0p.	Dye water and grease.	—	—	
Prickleden Dyehouse	George Farrar	Wool dyeing	6	—	—	Dye liquor.	—	—	
Round Bottom Mill	Joseph Pogson	Manufacture and machine making.	56	Steam	None	Engine water.	—	—	
Victoria Mill	Thomas Hinchcliffe & Sons	Woollen manufacture	60	Steam and water	1a. 0r. 0p.	Dye and scour water.	—	—	
Sandy Mill	Messrs. Roberts	Do.	25	Do.	680,625 gallons	Scouring water and mud	14,520 cubic feet once in 10 years.	—	
Bottoms Mill	Barber & Company	Do.	100	Do.	4,900,500 gallons	Do. Do.	100 cubic yards a year.	—	
Spring Lane Mills	John Brook & Sons and others.	Woollen manufacture and dyeing.	300	Steam	303,750 gallons	Dye and scour water.	—	—	
Bottoms Dyehouse	Joseph Roberts	Wool dyeing	7	Steam and water	405,000 gallons	Dye liquor and mud	1,200 cubic yards once in 12 years.	120,000 gallons a week.	
Hinchcliffe Mill Dyehouse	Roberts Brothers	Do.	1	No Power	6,750 gallons	Do. Do.	—	2,400 gallons a week.	
Hinchcliffe Mill	Benjn. Butterworth & Co.	Woollen Manufacture	120	Steam and water	1a. 0r. 0p.	—	—	—	
Holme Bridge Dyehouse	J. & J. Midgley	Wool dyeing	12	Water	60,750 gallons	Dye liquor	—	12,000 gallons a week.	
Holme Bridge Mills	Joshua Barber & Sons	Woollen manufacture	140	Steam and water	0a. 1r. 0p.	Dye and scour water.	—	—	
Brownhill Mills	Charles Beardsell & Sons	Do.	70	Do.	2,450,250 gallons.	Do. Do.	—	72,000 gallons a week.	
Bank End Mill	Crosland & Moorhouse	Do.	20	Water	0a. 3r. 0p.	Scour water.	—	—	
Upper Digley Mill	George Tinker	Do.	7	Do.	5,062 gallons	Dye and scour water	—	600 gallons a week.	
Bilberry Mill	Broadhead Bros. & Mason	Do.	30	Do.	30,375 gallons	Do. Do.	—	—	
Dean House Mill	Thomas Dyson	Do.	90	Steam	4,900,500 gallons	Do. Do.	—	—	
Ribbleden Mill	J. T. Taylor	Scribbling and milling	20	Steam and water	0a. 2r. 0p.	Scouring water and mud	1,613 cubic yards a year.	—	
Dover Mill	Do.	Manufacture and dyeing	100	Do.	0a. 1r. 0p.	Dye & scour water & ashes.	—	—	
Jane Wood Dyehouse	Edward Fozzard	Dyeing	8	Do.	0a. 1r. 0p.	Dye liquor.	—	—	
Swan Bank	Abel Cuttell	Woollen manufacture	60	Do.	—	Do. &c.	—	—	
Green Lane Mill	Robert Ramsden & Sons	Do.	20	Do.	0a. 1r. 0p.	Scour water, ashes, and mud from dam.	—	—	
Wash Pit Mill	Lamb & Thompson	Do. and dyeing	52	Steam	101,250 gallons	Dye and scour water	—	1,000 gallons a week.	
Choppard's Mill	Charles Cromack	Do.	14	Water	—	Scour water	—	Water from 18 cwt. of soap per year.	

REPORT of Mr. JOHN H. ABBEY—*continued.*

MAG BROOK.

Name of Mill, &c.	Owner or Occupier.	Description of Work.	No. of Hands.	Decription of Power used. Water or Steam.	What Reservoir Room.	Description of Refuse turned into Stream.	Quantity of Solid.	Quantity of Liquid.	Remarks
Armitage Bridge Dyeworks	Tolson, Haigh, & Brook	Scouring, dyeing, & finishing	35	Steam	202,500 gallons	Dye water	—	1,298 gallons a week.	
Thirstin Dyeworks	Farrar Brothers	Wool and woollen dyeing	26	Water and steam	0a. 1r. 20p.	Dye wares and mud from dam.	1,000 cubic yards once in 10 years.	—	
Moll Spring	H. & G. Oldham	Dyeing and finishing	80	Steam	1,400 square yards	Spent dye liquor.	—	—	
Lord's Mill	Heaps & Walker	Manufacture and dyeing	100	Water and steam	45,562 gallons	Do. Do.	—	4,680 gallons a week.	
Cocking Steps Mill	John Wrigley & Sons	Woollen manufacture	200	Steam	122,500 square yds.	Refuse from dyehouse and mud from reservoir	120 cubic yards a year.	—	Standing.
Hall Mill	Edwin Beaumont	Do.	—	—	—	—	—	—	
Crosland Mills	John Heap & Brothers	Do.	160	Water and steam	0a. 2r. 0p.	Dye and scour water and mud.	800 cubic yards once in two years.	—	
Bentley Mills	Charles Brooke & Sons	Silk throwing	200	Steam	None	Refuse from dyehouse.	—	—	
Spink Mire Mills	Ainley & Taylor	Woollen manufacture	60	Water and steam	317,906 gallons	Do. and ashes and mud from reservoir.	20 tons of ashes and 101,730 cubic feet of mud a year.	—	
Old Mill	Geo. Morton & Co.	Manufacture and dyeing	20	Water & steam	196,500 gallons	Dye and scour water.	—	—	
Brow Mill	Hamer Taylor	—	—	—	—	—	—	—	
Meltham Cotton Mill	Edward C. Goody	Cotton spinning	100	Steam	287,093 gallons	None.	—	—	Standing.
Do.	James Kilburn	Machine making	—	—	—	—	—	—	
Lane End	George Garside	Do.	5	Water	—	—	—	—	
Lower Sunny Bank	John Farrar	Scribbling, fulling, & spinning	50	Water and steam	207,868 gallons	Dye and wash water.	—	—	
Owler Bars Mill	Do.	Do.		Water	263,837 gallons	Do. Do.	—	—	
Upper Sunny Bank	Amos Woodhead	Manufacture	26	Water and steam	220,975 gallons	Dye liquor.	—	—	
New Bridge Mill	Walker & Ramsden	Do.	24	Do.	773,600 gallons	Do. Do.	—	—	
Meltham Mills	Jonas Brook & Sons	Manufacture of sewing cotton.	1300	Do.	5a. 0r. 0p.	Refuse from bleach work, ashes, and night soil.	325 tons a year.	—	
Royd Edge Mill and Meltham Mill.	Joseph Hirst	Manufacture	290	Water and steam	1a. 0r. 0p.	Dye and scour water and mud.	605 cubic yards once in three years.	—	

NEW MILL DIKE AND JACKSON BRIDGE DIKE.

Stoney Bank Mill	Wimpenny & Bowes	Woollen manufacture	160	Water and steam	815,500 gallons	Dye water and scour water	—	14,870 gallons a week.	
Kirk Bridge Mill	Hugh Mellor	Rag grinding	20	Do.	—	Dye water	—	360 gallons a week.	
Newmill Mill	Charles Lockwood	Manufacture and dyeing	200	Do.	843,750 gallons	Soke and dye liquor and mud.	2,000 cubic yards per year.	6,450 gallons a week.	
Holme Bottom Mill	J. Hirst & Co.	Cotton spinning	10	Do.	50,625 gallons	Mud from reservoir	56 cubic feet a week.	—	
Lude Hill	Pitt & Booth	Woollen manufacture	80	Steam	112,500 gallons	Dye water and scour water	—	4,275 gallons a week.	
Jug Nook Mill	Eli Moorhouse	Manufacture and dyeing	90	Water and steam	—	Dye liquor	—	9,522 gallons per week.	
Wild Spurr Mill	Edward Hirst & Son	Do.	60	Do.	—	Do.	—	4,762 gallons per week.	
Scholes Mill	Moorhouse & Lockwood	Do.	53	Do.	101,250 gallons	Dye liquor, soke, ashes, and mud.	133 cubic feet once in three years.	4,336 gallons per week.	
Jackson Bridge Mill	Moorhouse & Allison	Do.	50	Do.	—	Dye liquor and soke	—	4,762 gallons per week.	
Dolroyd Mill	Moorhouse Brothers	Do.	20	Do.	1,633,500 gallons	Do. Do.	—	—	
Hepworth Mill	Mrs. Shaw	Dyeing and scribbling	50	Steam	337,500 gallons	Dye liquor	—	1,106 gallons a week.	
Lee Mill	Jas. & Jonathan Lockwood	Manufacture and dyeing	300	Do.	4,359,993 gallons	Dye liquor and soke	—	3,339 gallons a week.	

HUDDERSFIELD.

Mr. J. Thornton.

25 Oct. 1866.

Mr. Joseph Thornton (Huddersfield) examined.

3211*. (*Chairman.*) How long have you been inspector of nuisances to the Commissioners of Huddersfield?—One year and ten months.

3212*. How long have you resided in Huddersfield?—I have resided in the neighbourhood all my life, on the west side of the town.

3213*. What business did you follow before being inspector of nuisances?—Cloth finishing and manufacturing.

3214*. Since you commenced your duties of inspection which portion of the town has required most attention?—The lower parts.

3215*. Those on margins of streams and rivers?—The lower and worse drained parts of the town.

3216*. What kind of nuisances have you most frequently to complain of?—Bad drainage.

3217*. Have you to complain of unpaved courtyards and unpaved streets?—Of both.

3218*. Causing mud?—Causing mud and filth, and difficulty of cleansing.

3219*. Can you name any particular places where you have most nuisances?—Yards and courts leading out of Old Street, Peel's Yard, and Chadwick's Fold.

3220*. Are there privies and ashpits in those yards? In all of them.

3221*. Do the Commissioners empty the privies and ashpits, or do the people themselves empty them?—The Commissioners empty them.

3222*. And do they sell the refuse?—Yes.

3223*. To the farmers?—Yes.

3224*. Where do you store it?—At Mold Green.

3225*. Has there been any complaint about the storing of the refuse at Mold Green?—Yes, from the Mold Green people.

3226*. Of your causing a nuisance there?—They do not and cannot say that it is a nuisance, but they complain of it as an eyesore.

3227*. How much a load do the farmers give you for taking it away?—About 1*s.* 6½*d.* for a one-horse load, taking the general average of loads.

3228*. Will that be a ton weight?—It will be over a ton weight.

3229*. How long do you remember the rivers and streams in this district?—All my life.

3230*. How do you find them now as compared with what you knew them to be at first?—Very bad.

3231*. Discoloured?—Yes.

3232*. Have you many privies in your district which open direct into the rivers and streams, or which discharge their refuse into the stream?—Only two.

3233*. Where are they?—One is on the Shore-foot Mill goit, and the other is at Engine Bridge, the county bridge.

3234*. Is that the bridge which you pass in going from Huddersfield to Lockwood?—Yes; and the water from the turnpike road washes into the cesspool, and the soil is taken into the river.

3235*. Have any complaints been made of those privies?—None whatever.

3236*. What is the mill called upon the lower side of that bridge, which blows out a quantity of waste material on the banks of the river, on the left-hand side going to Lockwood?—It is Eastwood's mill.

3237*. What is that refuse which is blown out upon the banks?—The dust from the teazing of the woollen and the cotton material.

3238*. To whom does the mill belong upon the upper side?—The executors of Joseph Kaye.

3239*. That is the mill from whence ashes are thrown in?—Yes.

3240*. There is a mill higher up on the opposite side?—Yes, a small mill belonging to a cloth finisher.

3241*. Sometimes ashes are shot on the lower side across towards Huddersfield, and on the other side across towards Lockwood, and they make a barrier on both sides?—Yes, that is Messrs. Starkey's mill.

3242*. Have you anything to do with that matter, does it form a nuisance which you can complain of?—No. I believe that that is a common law nuisance.

3243*. What is the state of health in the worst districts?—We had a great deal of fever last season. I believe that it was very general throughout the country, according to the Registrar General's return.

3244*. Do you know the relieving officer?—Yes.

3245*. Is there more than one relieving officer?—There is only one for Huddersfield.

3246*. Is he here?—Not that I am aware of.

3247*. Do you know where he applies the most relief?—It will be in the lower and Irish parts of the town.

3248*. Is it in the places where they have to complain of most nuisances?—Among the Irish population.

3249*. Are there many Irish resident in Huddersfield?—A great many.

3250*. What are they chiefly employed in?—They are labourers, masons' labourers chiefly, and excavators.

3251*. Are there more in your opinion now than there were some years ago?—I believe that there are.

3252*. Do you think that the death rate has at all increased since they congregated there?—I cannot speak to that, on account of the short time that I have had the district under my inspection. I have taken the death rate every month from the registrar for the Commissioners. I have a report here. I have made a comparison between the rich districts of the town and that district which is most affected by bad drainage and Irish population.

3253*. Have you written it out in the form of a report?—I have.

3254*. Will you read it?—I will. I have drawn up this report with a view to meet the questions in the printed inquiry. (*The same was handed in, and is printed at the end of the evidence of the witness.*)

3255*. (*Mr. Harrison.*) You have mentioned that refuse is discharged into the river from gasworks?—I am not aware that any refuse from the gasworks in the town gets into the sewer; I allude to private gasworks and village gasworks in various localities. I have frequently seen gas tar swimming on the top of the floods as I have gone over the bridges. I saw it only a few days ago.

3256*. What becomes of the refuse from the town gasworks?—Above the town gasworks when I commenced inspecting there were great complaints in Fitzwilliam Street of the stench from the sewers; the sulphuretted hydrogen drove parties out of their houses who had untrapped drains and sinks. I strongly suspected that matter from the gasworks got into this sewer. I went down to the gasworks and examined the premises minutely, and I was satisfied that there was not any matter from the gasworks which went into the sewer, though they had a communication with that sewer; the only matter getting in, I think, is the surface water from the premises, which might contain a little refuse lime.

3257*. Then the other refuse is utilized in some way or other?—It is.

3258*. Is there any reason why in the small villages and in the private gasworks it should not be utilized in the same manner?—I know that a great many of them sell their refuse, but sometimes they empty it into the river, and it causes a very great stench.

3259*. I wish you to explain to us with respect to the canal basin; you say that the basin receives the foul water, and that the pure water which comes down from the canal instead of supplying that basin is passed into the already polluted river?—That is so. The junction of the two canals is at the west end, and the river enters at the west end. The water which runs into that basin from the river was intended to supply the Shore-foot Mill with water, and clear water comes down by the canal from Marsden; the Shore-foot Mill is capable of taking it in. I have watched the water many times, and I believe all the Marsden canal water passes down the goit to the water-wheel.

3260*. Then do you mean to say that the canal basin, which is now a nuisance to the town, might be supplied with clear water by some arrangement?—It might by a little contrivance have all the water from

Marsden, if that water was brought into it instead of being passed through the water-wheel. I believe that that mill has a right to draw water from that canal basin, which is of a considerable extent, till the water gets to a certain depth.

3261*. Have you observed the floods in the river during your residence in Huddersfield, have they increased or diminished?—I should say that the floods are not so great as they were formerly, that has been my impression for several years back; the water supply down the river is not so great as formerly.

3262*. In dry weather?—In dry weather.

3263*. You think that neither the floods have been so great, nor the dry weather supply?—They have not.

3264*. How do you account for that?—I account for it by the extra reservoir room. The embankments of some of the reservoirs have been considerably raised. I believe that a greater provision has been made for husbanding the rainfall.

3265*. The intention of that is to diminish floods and to give a more regular supply in summer time?—Yes.

3266*. But you seem to say that it has diminished floods and lessened the supply in the summer time?—Yes, I do say so.

3267*. (*Professor Way.*) You have said that the canal is in a very bad state?—Yes.

3268. And that it has had no chance of being flushed as the river is?—No.

3269*. If the river and streams are purified the canal which receives its water from the streams will gradually get purified too?—It will become purified as a natural consequence.

3270*. You have mentioned that at one time zymotic diseases were very rife in the town of Huddersfield, and in the outlying districts. Did you at all associate that with the condition of the water, or would it result from the very fact of there being a quantity of water in the neighbourhood; had it anything to do in your opinion with the impurity of the water?—I ascribe the great prevalence of epidemics in this district to the overcrowding of the dwellings; there is a great want of dwelling-houses for the labouring classes in this neighbourhood. I find in several instances that there are one, two, or sometimes three families in one house.

3271*. The evils incident to over-crowding would be increased by effluvium from the river, by bad atmosphere?—Yes.

The witness withdrew.

REPORT (referred to supra, Q. 3254*) of Mr. JOSEPH THORNTON, Inspector of Nuisances to the Commissioners of HUDDERSFIELD.

The Huddersfield sewerage has five outlets, viz.: one at Grove Bridge, two at Shorefoot Mill tail goit, one at Aspley below the bridge, and one at the bottom of Spring Lane, Longroyd Bridge.

The private drains are those of Messrs, Learoyds, Reid Halliday's, Richd. Armitage's, the mills and dyeworks at Seedhill, Lower and Upper Aspley, Colne Road, Engine Bridge, Folly Hall, and Longroyd Bridge the drains from which places empty direct into the river.

The River Colne is polluted to near its several sources on all its branches by the mills, dyeworks, gasworks, greaseworks, and dwelling-houses in the localities through which its branches flow.

I remember the time when the river water was used for domestic purposes, and I have caught fish therein.

The canal at Aspley is supplied with water from the river. The Shorefoot Mill has its supply of water from the canal basin. The Huddersfield and Ashton canal has its junction with the Ramsden canal at this basin. The pure water for the Huddersfield and Ashton canal passes down the goit to the Shorefoot water-wheel and not into the basin. The basin is often dredged of the filth and wreck that flows into it from the river.

During warm weather the stench from the canal is very bad. The decomposition and fermentation in the water of the basin is perceptible by the bubbles that are continually rising to the surface, and people complain about it; excepting the deposit, the canal is in this state down to Cooper's Bridge, a distance of three miles. This canal is a greater nuisance to the town than the river; the river is cleansed by the floods, the canal never, but it is diluted at times with fresh water.

The river passes Huddersfield on the south and east, the polluted canal is on the east side and is close adjoining a dense population. The south and south-west winds convey the effluvia from the river on the south over the town; the east, north-east, and south-east winds do the same.

The town contains a population of 23,379. The rate of mortality to 1,000 persons living, for the 12 months ending September 30th 1866, was 24·9; the number of deaths from contagious diseases in the same period were 76, being at the rate of 3·2 per 1,000.

The state of the river and canal has become a great nuisance. The mortality on their margins is much higher than in the other localities. The number of deaths from zymotic diseases in the river and canal district were 31 in a population of 5,600, being at the rate of 5·5 per 1,000. In the other portion of the improvement boundary the population is 18,779, and the deaths from the same causes were 45 or 2·3 per 1,000. The population in both districts are of all classes.

The Hebble Beck is on the north side of Huddersfield and drains the greater portion of the township of Lindley and Fixley, also the hamlets of Fartown and Marsh in the township of Huddersfield. This beck is polluted with the sewage of the mills, dyeworks and dwellings of the above places, and is a great nuisance to the inhabitants in its neighbourhood. People have complained of the stench from this brook. I have frequently seen persons place their fingers to their noses when passing over the beck. The deaths from contagious diseases in this locality were 4 or 4·6 per 1,000.

I have been inspector of nuisances nearly two years, and have observed that after long prevailing east winds, the death rate of the town has increased. The cause I think is this, the town inclines to the east and has hills on three sides, the valley from Huddersfield to Cooper Bridge is formed by high hills, the river and canal run the whole length of this valley, a distance of three miles; the miasm from which is brought back and spread over the town, at the same time this wind impinges on the streets grids and enters the outlets of the sewers, and forces back the effluvia into the streets and houses through the untrapped drains. The wind itself has its influence. All these are the cause of the increase in the rate of mortality during the prevalence of eastern winds.

The mills and dye works that abut upon the streams, all more or less throw their ashes therein. I have known the Marsden brook polluted several times for weeks together with sand and wreck, by the sludging of the tunnel end reservoir at Marsden; every milldam, steam boiler, and engine pump being injured thereby. This reservoir is mainly filled with wreck from the tunnel spoil bank on one of the streams above, and the by-wash of the Haigh reservoir is turned on the moor and is making for itself a course and a ravine, The debris is washed down by the floods into the reservoir there to deposit, first the stone, then the sand, the clayey mud, and last the light black mould. This great evil might be easily remedied at a trifling cost. They say that it is lawful, for that which come with the stream to be sent forwards by the stream, thus entailing a great loss to every millowner below. The law ought to interfere and compel all owners of reservoirs and mill dams to get rid of the wreck by other means than sending it down the watercourses.

The water supply is affected by drainage and cultivation which causes the rainfall to run off more quickly. The reservoirs on the hills act beneficially by husbanding the water, and they in great measure prevent floods. They might be increased to the extent necessary to catch all the rainfall. The hills and valleys of this district are being denuded of trees which will lessen the supply. The planting of rocky places, and of lands not worth cultivating would increase the supply, and should be encouraged. Trees precipitate the driving mists so common to high lands, and they prevent evaporation, they collect a large quantity of water which would be lost to such districts.

There are two ways of freeing the rivers from pollution, by filtering and applying the sewage to the land. Where the water supply is little, this application of the sewage would be too great a drain on the rivers and brooks, unless it was thrown far enough back as to affect

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the springs of the district that it originally drained from.

The liquids from dyeworks, chemical works, gas works, and similar trades whose liquid refuse would be injurious to vegetation should be kept out of the systems of sewerage, and undergo a separate filtering through a strata that would deprive it of every impurity before entering a drain or a river. The sewage of towns and manufactories should undergo a like process before being turned into the rivers. The filtering strata when saturated would have a commercial value as tillage. If fish could live in the filtered water the system would be complete.

Every local authority is empowered by recent Acts of Parliament to drain their districts, and have the powers to purchase and relet or to rent land for the purpose of applying the sewage of towns thereon.

(Signed) JOSEPH THORNTON,
Inspector of Nuisances.

Mr. E. Greenwood.

Mr. EDWARD GREENWOOD (Huddersfield) examined.

3272*. (*Chairman.*) Have you a canal under your superintendence?—Yes.

3273*. What canal is that?—The Huddersfield canal, from Huddersfield to Ashton, and the broad canal from Cooper Bridge to Huddersfield.

3274*. What length of mileage do the two canals make?—24 miles, from Huddersfield to Ashton; the Huddersfield canal, which is the narrow canal, is 20 miles long; and the broad canal, or Sir John's canal, from Cooper Bridge, is four miles in length.

3275*. How long have you been inspector of those canals?—I have had to do with the broad canal ever since it became the property of the London and North-western Company, that is some 17 or 18 years, and with the Huddersfield canal 34 years.

3276*. In what condition do you find the water of those canals now as compared with what it was when you first had charge of them?—The water in the narrow canal is about the same, but the water in the broad canal is far more filthy than it was previously.

3277*. What does that filth arise from?—Principally from dyeworks and other manufactories, and the amount of solid matter put into the river, and ashes, and excavations from foundations, and also the large quantity of debris which is necessarily brought down from the hills.

3278*. What is the name of the stream which feeds your canal?—The broad canal gets its principal supply direct from the river at Huddersfield.

3279*. What is its name?—The Colne River, which is also fed from the Holme; the canal takes in the water just below where they join.

3280*. You have arrangements, I presume, for taking in the water or shutting it out, by cloughs and a goit?—Yes.

3281*. And you can shut it out when there is a bad flood, and take it in when it is bright, if it is ever bright?—So far as the broad canal is concerned we have not that privilege, for the simple reason that Sir John has works at Shore Foot Mill, which are supplied from the same source, and of course they work frequently when we, if we had the opportunity, should keep the water out so as to render the canal far less polluted.

3282*. Does the land on both sides belong to Sir John?—Yes.

3283*. And above?—Yes, for a long way up.

3284*. Then the land which has been leased for mill purposes belongs to him?—Yes, the greatest portion of the land just in the immediate neighbourhood on both sides of the river does belong to Sir John.

3285*. Do you know whether there have been any stipulations in the leases to prevent pollution?—I am not able to speak to that.

3286*. But pollution does arise from the working of the mills situated above the canal?—Perhaps you do not clearly understand me. The summit pool of the broad canal, which is nearly a mile in length, and which runs through the bottom part of the town, is actually now used as a mill dam. As the last witness very justly remarked, clear water comes down the Huddersfield canal, which is the narrow canal, and the feeder from the river Colne comes at right angles across the canal to Shore Foot Mill, so that what ought to improve the condition of the broad canal is turned out into the river.

3287*. Then any pollution in the canal is an accumulating one?—It takes a great deal more cleansing now than it did seven years ago.

3288*. Does the water ferment in the hot weather as described by the last witness?—Yes, to a certain extent. There was one thing which the last witness mentioned which seemed rather paradoxical; he stated that the water in the basin was worse than the water in the river, which basin gets its supply from the river; but he forgot to mention one cause, which is this: unfortunately a great deal of night soil is laden into boats at the end of the basin, generally in the night, and instead of tipping the night soil into the boats, I am sorry to say the men tip a great portion into the basin, and that is one reason why the water ferments and becomes offensive in hot weather.

3289*. Do you mean to say that they tip it into the water?—Yes, the carts are brought in the night, and, through carelessness, instead of tipping it into the boats the men tip it into the basin.

(*Mr. Thornton.*) It is tipped on to the wharf and then cleansed and thrown into boats.

3290*. (*Chairman.*) And if it rained very heavily the rain would wash a part of the soil from the wharf into the canal basin?—No, it would wash on to the road.

(*Mr. Greenwood.*) The soil in some instances is shot in out of the carts, not in all instances of course. You can have an eye-witness who has seen it till the soil has accumulated nearly to the top of the water.

3291*. Have you no power as inspector of the canal to prevent that, or to fine these people for improperly throwing in night-soil?—Yes, but the mischief is principally done in the night.

3292*. Have you any men working in the basin?—Not continuously.

3293*. Have they ever complained to you of the foul state of the water during hot weather?—A person whom I have alluded to has done so, and he gave me that as the principal cause.

3294*. Is that some person whom you have in your employment?—Not at all, but he lives near the place.

3295*. Do you think that there are any means of reducing this nuisance, and getting rid of it altogether?—It would be much better for the canal, and for the manufacturers all along the canal, if the Shore Foot Mill water was done away with altogether, or taken under the canal, as Mr. Thornton describes, because the water which comes down the narrow canal, and which comes in a very pure condition, would supply the broad canal.

3296*. Would it cost much to effect that alteration?—No. I have no doubt that the company would be very glad to make the alteration, if Sir John would give up his claim to the canal basin as a mill-pond. I think that it would be to the joint interest both of Sir John and of the company, and of the whole district.

3297*. (*Mr. Harrison.*) Is there only that one mill which takes water from the basin?—After the water has left the Shore Foot Mill it then passes to another mill-fall before it flows into the river; the alteration would not sacrifice the interest of those two mills. They would not lose water, for they could take river water, only the river water of course wants conducting under the canal, so as to be separated from it.

3298*. A very great nuisance, four miles in length, is created for the sake of the power given to two mills?—Precisely so.

3299*. How is the narrow canal supplied with water?—Entirely from flood water impounded in reservoirs.

3300*. Do you know the area of those reservoirs?

—Yes, there are 10 of them, and they are about 80 acres in extent.

3301*. What is the gathering ground?—I am not prepared to state the exact number of acres of gathering ground, but three out of the 10 flow the other way, towards Lancaster.

3302*. (*Chairman.*) On the Rochdale side?—Yes. There is one thing which I wish to state. It has been quite apparent to me that through heavy matters which are thrown in the bed of the river has risen within the last 10 or 15 years at least over two feet I should say all round this neighbourhood, and if some stop is not put to the practice it will become before very long of very serious consequence to property abutting upon the river where the situation is low.

3303*. You mean that the river will flood the adjoining property and seriously damage it?—Yes; the bed of the river is gradually rising year after year till low property, which before was not much flooded or very rarely, will become almost continuously in water.

3304*. You have also heard that there is some very valuable mill property in the same condition?—Yes, I heard the evidence this morning to that effect. It has also occurred to me that the time will come when it will be desirable, and I think that it is desirable at present, that a large reservoir should be constructed near the summit of the hills of the Colne and likewise of the Holme, with a view to flush out the river in summer time.

3305*. Have you ever had much to do with flushing?—Yes.

3306*. How far do you think that the effect of a flush would be felt down a river like either the Colne or the Holme?—That would all depend on the size of the reservoir and the capacity for flushing.

3307*. Did the Holmfirth flood at all flush the river beneficially?—There was a deal of wet, and the flood without that would have been sufficient.

3308*. Do you think that it at all lowered the bed of the river in any place?—No; I was not thinking of scouring out the bed of the river, but I think that it would have some such effect as I will describe. For instance, we have had six or eight weeks of fine weather in summer time when the flow has been very little, and if rain falls so as to form a sharp fresh the water becomes very turbid, and the stench is awful for a time.

3309*. Then you look to floods to dilute the foul water and to carry it away?—Yes.

3310*. You do not mean a flush so as to deepen the bed of the river?—No.

3311*. (*Professor Way.*) You mean just to carry away the lighter materials?—Yes.

3312*. (*Chairman.*) Do you not think that you would be seeking a doubtful remedy for keeping the river pure, and a remedy which would be bad economy?—I do not know as to the matter of expense, but I see no difficulty in keeping out the heavy matter.

3313*. And you think that you would be able to flush at short intervals the foul matter?—Yes.

3314*. Would it not be much better to keep out foul matter altogether?—Yes, if it is practicable; it might be pumped up.

3315*. (*Professor Way.*) Do boatmen living on the bank of the river suffer from any peculiar diseases?—No. There is one statement which Mr. Thornton had in his report which I wish to correct. He gave the Commissioners to understand that there was a large quantity of refuse brought from the moor in consequence of the water flowing over the bye-wash or waste weir of the Haigh reservoir, and I wish to state that the Haigh reservoir is supplied with two bye-washes, but that the water is never allowed to flow over either of them, because when the reservoir is full the water is turned out.

3316*. (*Chairman.*) The flood water comes down the river all the same, although it does not come exactly in the way which he stated?—Just so.

3317*. And it will not make any difference whether you turn it over a bye-wash or over a side conduit.—No; but I understood part of his report to show that the bye-wash coming over the Haigh reservoir brought debris down from the moors.

3318*. And you do not think that it does?—Certainly not; though there is no doubt at all that there are large quantities of debris brought from the moors in various places, the hills being so precipitous.

3319*. And the sand slips up from the washing of the stones against each other?—Exactly.

3320*. (*Mr. Harrison.*) Do you allow any refuse to come up the narrow canal?—No; there are certain sewers which ought to be kept out.

3321*. If those were kept out the water would be very pure?—Yes.

3322*. Do you supply any of the mills from the canal?—Yes; the water of the river is so bad that they cannot do without canal water.

3323*. What mills do you supply with water?—Nearly the whole of those in this district, for scouring purposes and for dyeing.

3324*. Do you do so through the town of Huddersfield?—Yes, all the way down to Cooper Bridge.

3325*. From Huddersfield down to the Calder the river water is impure?—Yes; but the principal part of the mills commence in the town and extend for about a mile, or a mile and a half, down towards Cooper Bridge.

3326*. Is the water pure there?—No; the principal portion of the mills are at the top part, though all the way down they take canal water.

3327*. If the foul water were prevented from getting into the canal might the canal be a means of supplying a quantity of very pure water to the mills?—Quite so.

3328*. (*Chairman.*) What rate of charge do you make for water to mills which take your water?—Where it is used for steam power we charge 5*s.* per horse per annum, and the condensed water is returned into the canal again.

3329*. For washing what do you charge?—According to the capacity of the pipe or of the pump.

3330*. For a pipe an inch in diameter what do you charge?—We charge so much for a pipe an inch in diameter, and for all others in the same proportion. If you will excuse me I will decline to give the price.

3331*. But the manufacturers know what they pay?—Certainly.

3332*. I suppose that you have separate arrangements with each of them?—Yes.

3333*. They are merely trade arrangements?—Just so. It would be a great benefit to the mills at the bottom of the town if the water in the broad canal was as pure as it is in the narrow canal, and I have suggested the taking of a large pipe down the bottom of the canal from the first lock of the narrow canal down the broad canal to a bridge a certain distance below, so that all the mills could pump direct out of the bottom of the canal or pipe instead of out of the canal itself.

3334*. (*Mr. Harrison.*) Is the quantity of water which you collect in these reservoirs such that you could supply the canal with what water is requisite and have a considerable quantity to spare for manufacturing and other purposes?—Yes, by increasing our capacity we could collect almost any quantity.

3335*. (*Chairman.*) Would not it be worth your while to do it so as to sell the water for trade purposes up to the extent of your capacity?—Yes, I have no doubt of it.

3336*. Is not Yorkshire very thirsty for good water?—Yes, more and more so every year in this neighbourhood.

The witness withdrew.

HUDDERSFIELD.

Mr. F. R. Jones.

25 Oct. 1866.

Mr. F. R. Jones (Huddersfield) examined.

3337*. (*Chairman.*) Are you a land surveyor?—I am.

3338*. How long have you practised in this district?—40 or 50 years.

3339*. Are you pretty well acquainted with the condition of the lands and streams in and around Huddersfield?—I am, and I have been for that period.

3340*. Have you been much engaged in the transfer or lease of land for mill purposes?—I have.

3341*. Have you found much increase in the value of land within the time that you have lived here?—Yes, a great increase.

3342*. Is that increase at all contingent upon water rights?—Certainly.

3343*. When you are conveying an estate for mill purposes of course the water is almost as much a consideration as the land?—Not altogether when the water is required for condensing purposes.

3344*. Are there any clauses put into leases with reference to the water in any way as that it shall not be wasted?—That it shall not be fouled.

3345*. Is there any power to enforce those clauses?—There is a great difficulty about it.

3346*. What kind of clause is it; is it a special clause which each landowner frames for his own protection, or a general clause?—Each landowner frames a clause for his own protection; they are special clauses, under special circumstances.

3347*. I presume that the lessor stipulates that the person taking the water shall return it to the stream below him?—Yes.

3348*. Does the lessor also stipulate that the lessee shall return it in a pure state?—That cannot be altogether accomplished.

3349*. The lessee is to have the use of it?—Yes.

3350*. It is hardly necessary to ask you whether the streams are worse than they were when you first knew them?—Yes, and they are daily getting still worse.

3351*. And the number of mills is daily increasing?—Yes, very rapidly.

3352*. Have any facts come to your knowledge as to the rising of the bed of the stream at any particular points?—No, but I daresay that that has been the effect of tipping in materials.

3353*. Some of the old county bridges would show that is the case?—Yes, but I do not think that I have noticed them sufficiently.

3354*. It would be very easy to ascertain whether the bed of the river had been raised underneath Lockwood Bridge?—Yes, but I have not noticed it sufficiently to judge. I remember when there was fishing in all these streams, and good fishing too, but now there is scarcely a fish in any of them.

3355*. Foul as the water is, is it not a hundred times more valuable now than it was when you had fish in it?—Yes, no doubt about it.

3356*. And if the question of fish were the question involved it would not be worth while to do much to bring the fish back?—No; I only state that fact about the fish to show the impurity of the water.

3357*. Did you hear the evidence of Mr. Abbey?—Yes, and I thought that his information was very valuable indeed on this question.

3358*. Do you generally agree with the statements of Mr. Abbey?—I quite agree with him; I think that his report is a very valuable one.

3359*. And you know that this pollution has grown up with the growth of the trade and is carried on to a great extent?—Yes, and is constantly increasing.

3360*. And that if left as it has been heretofore without any superintending action it will naturally increase?—Yes, so that the water cannot be used for dyeing purposes.

3361*. And is it not quite possible to neglect the river and to add impurity to impurity until the river itself will be destroyed for even the coarsest fabrics?—Certainly, the same as it is at Dewsbury and Batley; the river water is scarcely useable there.

3362*. At Dewsbury and Batley is the river more polluted than here?—Yes, and at Bradford the stream is smaller.

3363*. You know what the Bradford Beck is?—Yes.

3364*. I believe that you have nothing so bad as that here?—Nothing.

3365*. What is the value of land per acre having river frontage and water rights?—It depends upon the situation.

3366*. Take one of the best situations?—Some land here from $1\frac{1}{2}d.$ and $2d.$ a square yard per annum to $4d.$

3367*. Over the whole area?—Yes.

3368*. And that is perpetual?—Yes; some of the leases are for 999 years. Sir John's are limited to 99; they are so limited recently.

3369*. In what per-centage do you think that land has increased in value since you first knew it?—I may say 50 per cent. in some localities.

3370*. Is it within your experience that the polluted condition of the rivers tends to reduce the value of the land?—For mill purposes decidedly, because manufacturers require pure water for their dyeing purposes.

3371*. If you could offer mill sites with comparatively bright water the land would be more valuable?—No doubt; we should ask a higher price for it, because manufacturers, if they cannot use the water in the river, must find artificial means of obtaining water by bore holes.

3372*. If it is necessary to carry out preventive measures in manufacturing districts to protect the rivers, and if the annual cost is to be defrayed by a rate, do you think that it would be fair to levy any part of that rate upon the land?—I think that it would.

3373*. As well as upon the mills?—Yes. I think that it should be borne in certain proportions according to the value of the property.

3374*. You think that in carrying out whatever was necessary to benefit the general trade of the country the burden should be equally borne by all who could be fairly estimated as receiving a benefit or likely to receive a benefit?—Certainly.

3375*. Are there any paper mills in this part of Yorkshire?—No; there are some near Halifax.

3376*. (*Mr. Harrison.*) In the sale of mill property do you find the water power come in as an important element in the value?—Yes, it does; but it is less so than it used to be.

3377*. Is that in consequence of the cheapness of coal?—Yes; and a person who uses steam can have a mill where he likes, in the best situation, whereas the water power may be remote.

3378*. What is the valuation of water power per horse power?—It is very much reduced compared with what it used to be. I can hardly say off-hand what it is, as it is so much reduced.

The witness withdrew.

Mr. E. Eastwood.

Mr. E. Eastwood (Huddersfield) examined.

3379*. (*Chairman.*) Upon what stream are your works situated?—The main works in which I am now employed are on the Colne.

3380*. Have you more than one works?—I am interested in works both on the Holme and on the Colne, and I have also the superintendence of large works below the town, very near the junction with the Calder.

3381*. Are those works in Mr. Abbey's list which you heard him read over?—Mr. Abbey stated in his report that he had not got information at the point where I am.

3382*. Did you decline to give him the information?—A circular was sent with an indication that he would call upon me and confer, which he has not done; there is no indisposition to give the information.

3383*. Will you supply the information?—Yes, as far as lies in my power to do so; some of the questions are difficult.

3384*. What number of hands do you employ altogether?—I have a rather large mill to which the power is supplied, and there will be perhaps 120 men there. One is a smaller concern established 50 years ago where I am dyeing, and at the other I let and furnish the power. I consume the coal and furnish the power.

3385*. Do you use both water power and steam power?—Yes.

3386*. Do you know the relative value of water power and steam power to a manufacturer; I mean per horse power per annum?—There is a very wide difference. I should say that water power, with water-wheel and apparatus all fixed, might be calculated at perhaps 20*l.* a year, whilst steam power would be worth 50*l.*

3387*. That is, if you were supplied with the steam power?—Yes.

3388*. Why do you value steam power so much above water power?—There is a very good reason. Steam power is permanent, and may be relied upon; water power is intermittent, and never can be relied upon if much manual labour is wanted. Water power is of very little value except as an auxiliary in operations where great labour is required.

3389*. Except you have it in a much larger proportion than is supplied by these small becks?—Yes, and then it would approximate but would not be equal to steam power. I say that in round numbers steam power is worth 50*l.* per annum, whilst water power from its intermittent nature would not be worth 20*l.*

3390*. A 20-horse engine would not cost anything like 1,000*l.* a year to work, or one-fourth of that amount, would it?—More than one-fourth. With my engine I consume about 1,800 tons of coal a year. Mine is a 35-horse power engine. In connexion with power worth 50*l.*, all or nearly all our operations require an auxiliary heat.

3391*. How long have these mills been under your superintendence or in your possession?—One portion of the premises which I am now working has been in my possession for nearly 40 years.

3392*. Do you use much water in your operations?—Yes.

3393*. For both washing and dyeing?—For both washing and dyeing.

3394*. Do you use soap for scouring?—Yes.

3395*. Do you utilize the soapsuds?—No.

3396*. Would it not pay to extract the oil and grease from the suds?—That depends in a great measure upon the physical conveniences which there are for collecting them.

3397*. What do you with the spent woods of the dyes?—75 or 85 per cent. of the spent woods are burnt at my place.

3398*. They are mixed with the fuel?—Yes.

3399*. What do you with the ashes?—I must confess, as Mr. Brook did, that we have hitherto turned them into the river.

3400*. As the handiest way of getting rid of them?—Yes.

3401*. What have you done with the dye water?—It has gone into the river also.

3402*. Without any attempt to clarify or purify it?—With none whatever.

3403*. Are there any complaints near you as to the state of the river?—There have been complaints both above and below me, and I am quite aware, with other millowners, of our liability to an action at law, but I suppose that we commiserate each other.

3404*. Are any of your vats or yards so situated as to be within the influence of floods?—Yes.

3405*. Are you more liable to floods than you were formerly?—I think not.

3406*. Has the bed of the river risen at your works?—Yes, but not so much as other witnesses have stated. We suffer very little from it, but in very extreme floods we have had damage done.

3407*. Do you suffer at all from scarcity of water in dry weather?—Yes, very much; we have not so much water as we used to have.

3408*. Have you any wells or bore holes upon your premises?—No.

3409*. Do you get any of the town's water for any of your purposes?—We do not get the town's water, but we get the canal water.

3410*. Did you always get the canal water?—We have had the canal water about a dozen years.

3411*. Can you dye as bright and good colours now as you could when you first commenced dyeing operations?—Equally good, using the canal water.

3412*. But suppose that you were confined entirely to the river?—We could not then conduct our operations.

3413*. Then if the canal should be made as impure as the river it would be to the very great damage of your works?—It would damage the whole of the works from two or three miles above Huddersfield to two or three miles below, unless other sources of water were obtained.

3414*. Do you think that if colouring matter and foul refuse, solid and fluid, were kept out of the river the water would be useable again for your purposes?—With the number of factories and dye places which there are I do not think that the river water would ever be equal to what it was at first.

3415*. Have you seen the operation of pumping dye water upon land?—No, but I am tolerably acquainted with it. Of course it is a mere matter of opinion. You ask my opinion, and I say that such apparatus may be resorted to when the stream is very small. In the instances which have been adduced the stream is a mere nothing in comparison with the river here. The quantity of water used by those people would be a very trifling fraction in comparison with the water used by several of the manufacturers in this neighbourhood. I mean, for instance, such as Starkey's and Brooke's at Armitage Bridge. At those two places they required more water for scouring in a day than Mr. Armitage used in a month when he was the defendant and Mr. Hardy was the plaintiff. I therefore fully approve of irrigation on a small scale, but upon a large scale I do not think it is possible. As to solid matter, I fully agree with the statements which have been made by most of the witnesses, that some mode should be resorted to by which solid matter could be prevented from being cast into the river.

3416*. Have you heard that road dirt and excavations from foundations, and ashes from furnaces, and other solid refuse of that class are now thrown into the stream?—I was quite aware of that before I gave evidence.

3417*. And you think that it would be desirable to take some means to keep those things out of the river?—Most decidedly. There is abundant material which it is desirable to keep out, which will otherwise be inevitably thrown in. A young friend of mine has given me an account to-day by which it appears that something approaching 100,000 bales of wool in a year will come and be worked within an area extending over a very small proportion of the water-shed marked upon the map.

3418*. What weight will that be?—I suppose 20,000 tons, and half of that alone would go in waste down the river.

3419*. Half of the whole weight of the wool?—Yes, close approaching it.

3420*. Has there been no attempt to keep that waste out of the river?—I never heard of any, nor do I think it practicable.

3421*. (*Professor Way.*) A great deal of that is grease and dirt from the wool, is it not?—Yes, grease and earthy matter.

3422*. It is not the waste of wool itself?—No.

3423*. (*Chairman.*) You are aware that dye water passed into a stream and so diluted purifies or clarifies itself as it flows down that stream?—Most decidedly.

HUDDERSFIELD.

Mr. E. Eastwood.

25 Oct. 1866.

I suppose that running down the bed of the river for two or three miles would very greatly improve the water.

3424*. If nature can do that in its own way, is it quite impossible that we may find some artificial means to clarify the same fluid before it goes into the river?—I did not say that it was impossible, but I think that it is impracticable on a large scale. In rivers on a small scale I think that it may be done.

3425*. You have not seen any experiment which would lead you up to that?—No.

3426*. Nor have you heard of one?—No.

3427*. Do you know that there are chemicals which throw down matters in suspension?—I am quite aware that what is suspended in water may be precipitated.

3428*. I suppose that intercepting conduits to take dye refuse from mills above past mills below would not be submitted to. Where water is so valuable for power each owner of property wants the water turned into the stream immediately it leaves the premises above him, where it has been used?—I, as one, should require it, and I think that if anything of the kind was attempted we should be without a river, and should have an artificial conduit, and that conduit could not, so far as I see, be made applicable for water power.

3429*. (*Professor Way.*) What are the principal dye woods and matters which you use; logwood?—There are the various dye woods, the names of which you know; indigo and solutions of different metals.

3430*. Chromate of potash?—Yes.

3431*. And tin for a mordant?—Yes.

3432*. And iron?—Yes, sulphate of iron and other things. In some operations of cotton dyeing metal solutions are used more extensively, but I am not a cotton dyer.

3433*. Do you find it necessary to use more mordant, we will say salt of tin, than you did when the water was in a better condition?—No, we have no occasion for that, because for dyeing purposes I have pure water, as good, I believe, as there is in England, and of so much value is that water that I have conveyed it to a property which belongs to me, fully half a mile from the canal, at an expense of some 300*l.*

3434*. What quantity of water do you use per day?—I could scarcely indicate it.

3435*. Is it 1,000 gallons?—I have not made a calculation in gallons, but I have made a rough calculation since I came into the room, and the quantity seems to me to be enormous. I am confident that in cleansing wool and for other purposes I should use 15,000 or 16,000 cubic feet of water.

3436*. That is about 100,000 gallons a day?—Yes.

3437*. That is including the water used for washing the wool?—Yes.

3438*. Are you supplied with that water from the canal?—It partially subsides before I use it. I do not get the whole of it from the canal. I wash the rough washing with river water.

3439*. Will you confine yourself to the dyeing process; what quantity of water do you use for that?—I can scarcely say, but a two-inch pipe night and day supplies me, and I have tanks for the more delicate operations.

3440*. At what pressure?—I will say four feet.

3441*. Supposing that the water in which you wash the wool were to be dealt with for the extraction of soap, as it is in some parts of this district, that would cause a reduction of the quantity of water which you would have to deal with in another manner, namely, the dyeing water, to a much smaller amount?—Yes; but when we resort to means to economize the soapsuds we deal with a much smaller quantity than I speak of.

3442*. (*Chairman.*) You mean that the soapy water is much stronger?—Yes; it is not so much diluted.

3443*. (*Professor Way.*) The emptying of the dye vats themselves does not give rise to a great waste of dye, does it?—There are many hundreds of gallons a day, or I may say thousands, but I think that not much valuable matter is lost by this.

3444*. That is a matter of computation?—Yes, and I am not prepared with the computation. The chairman alluded to the mill at the corner of the bridge, where the dust blew out, and I am ready to answer any questions upon it; I do not shrink from it.

3445*. (*Chairman.*) Would there be any difficulty in collecting that dust?—No.

3446*. Would it not be valuable as a manure?—It would be of very little value as a manure.

3447*. Has it ever been tried?—It has been tried; it has been tried mostly for mixing with manure from privies.

3448*. On the opposite side to your mill, from houses adjoining the bridge are not ashes thrown into the river?—Yes.

3449*. And your ashes also go in?—Yes.

3450*. And I suppose that all the way down the river, wherever the river is accessible, ashes are put in either from mills or from private residences?—Yes, and I think that it is very desirable to prevent it.

3451*. (*Mr. Harrison.*) Is the quantity of wool which you gave just now a return of the quantity used in the drainage area marked on the map?—It applies to a very small proportion of that drainage area, because a great extent of that drainage area is land where there are no inhabitants.

3452*. But the figures you gave represent the whole of the wool which is used within that drainage area?—I have been furnished with that information.

3453*. From what countries is that wool received?—A great part from the colonies, Australia, New Zealand, and the Cape, and some from Germany, and some from Spain, some from South America.

3454*. You say that nearly half of the wool goes into the river as dirt?—I say that fast approaching one half goes into the river as waste. From its introduction in a raw state to its leaving the warehouses I think you will find on the average that 100 lbs. weight of wool will not yield much more than 50 lbs. of finished cloth.

3455*. A part of this dirt is blown out of the wool?—It is.

3456*. And a part of it comes out in the cleansing of the wool?—Yes.

3457*. In that cleansing is not a considerable quantity of soap used?—Not much, I believe, is used in cleansing raw wool; there is an alkaline salt obtained, which is very much economized.

3458*. Is not much of the refuse in that part of the process utilized by Mr. Teall?—No, not in that process, that is in the fulling.

3459*. Might it be so used?—The grease is in too diluted a state, and the expense would be too great.

3460*. Is the wool generally washed in machines?—There are some special machines which are extensively used in this neighbourhood.

3461*. Can you tell me what quantity of water is used to cleanse, say a hundredweight of wool?—I would rather not answer the question.

3462*. Is some of the Australian wool made into fine cloth in this neighbourhood without any mixture with shoddy?—Yes.

3463*. Do you find that you can thoroughly clean the wool for that purpose in the machine?—Yes, you can thoroughly cleanse it.

3464*. Without any difficulty?—Yes.

3465*. In Gloucestershire, where they make similar fine cloth, I have asked them several times, and the answer has been that the machine does not sufficiently clean the wool?—On the average the wool can be got clean, but there are special cases where it is very difficult.

3466*. There are some kinds of wool which you doubt whether you could clean by that process?—Yes.

3467*. (*Chairman.*) Do you know of a process of extracting carbonate of potash from wool by steeping the wool in water before it is washed?—I am not aware of anything of the sort in this neighbourhood, but I have heard the matter spoken of, viz., of extracting oil from wool on somewhat a similar process to that used in crushing seeds.

3468*. There is a French patent by which a very considerable per-centage of carbonate of potash is taken from wool?—I do not doubt it.

3469*. (*Professor Way.*) Messrs. Teall is working it?—Yes. Fleece wool is rich in alkali.

3470*. (*Chairman.*) As science progresses and methods of utilizing every waste product are found as in gasworks you gentlemen in Yorkshire will get very rich?—I think that there is a great amount of matter in fleece wool which may be extracted so as to be utilized, but which is now lost.

3471*. (*Professor Way.*) The matter lost is principally grease I suppose?—Yes.

3472*. (*Chairman.*) Are you aware that Messrs. Teall is also working a patent for extracting indigo from the dye refuse, and getting quite as good a price for the indigo recovered as for new indigo, and that the recovered indigo is better in quality?—I am aware that some of the dye nets have been used for that purpose.

3473*. I do not refer to dye nets, but to the refuse?—Dyers in this neighbourhood extract all that they put in.

3474*. (*Professor Way.*) Of the indigo which you use the whole does not stay in the cloth?—The whole of it is not entirely fixed, but if the operation be properly conducted a very small proportion of it is not fixed.

3475*. In Gloucestershire, Mr. Harrison and myself have been told that not three per cent. of the whole indigo is to be found in the cloth?—In a very delicate apparatus you may waste it; 30 years ago I was practically an indigo dyer, and I am an indigo dyer yet, though I do not take any practical part in it, and I think that I am perfectly conversant with the process so as to convince me to the contrary of what you suggest.

3476*. Perhaps you mean that all which can be taken out of the indigo is taken out?—I believe that indigo is economized in this neighbourhood as closely as it is possible to do it. I do not deny that some of the indigo goes away, but I certainly demur to the proportion stated by you.

3477*. (*Chairman.*) Do you know the process of gas making?—I know it theoretically, but not practically.

3478*. Do you know that until recently gas products were a great nuisance?—Yes.

3479*. And are you aware that now there is not a single product which cannot be utilized?—I am aware of it.

3480*. And that you can carry on gas making in perpetuity without passing any foul refuse from the premises?—Refuse will not be passed because it has become too valuable.

3481*. There is nothing that will pollute a stream?—No; the utilization in that department is most astonishing.

3482*. And the gas tars, which formed the greatest source of pollution and were the most difficult to get rid of, have now turned out to be the most profitable?—That is perfectly correct.

3483*. And enormous fortunes have been made from them?—I believe so.

3484*. (*Professor Way.*) I suppose that it is the fact that in the ordinary process of manufacture the value of waste products is inconsiderable as compared with the general trade carried on, and it is only when it becomes an absolute necessity to attend to waste products that you much economize?—Exactly so.

3485*. They are what may be called bye products, which are not worth having?—Yes; and some of the premises are placed in such a position that you cannot utilize those bye products in a town like Huddersfield; they are very much cramped, and there is not space to do so.

3486*. (*Chairman.*) I suppose that trade regulates itself in the public market by the lowest seller, and that there is a tendency to bring down other manufacturers to his prices?—As a matter of course if one man can produce goods cheaper than another he has the privilege of selling them more easily, but his neighbours soon ascertain how it is accomplished, and they follow in the track.

3487*. With regard to river pollutions, if any special legislation took place for this portion of Yorkshire so as to increase the cost at which cloth could be made, and if at the same time the rest of England were not so dealt with, might not such legislation seriously prejudice Yorkshire trade?—Yes; if we were put to an enormous expense in purifying the water the increased expense of manufacture might drive the trade away. I trust that nothing of the kind will be done.

3488*. Do a great many of the cloths made in this district go abroad?—Yes.

3489*. Legislation then would affect the competition with other countries?—Yes.

3490*. You have not only home manufacture to contend with but foreign?—Yes.

3491*. Then it would become a question as to the cost of purification, whether it would be worth while to carry on the trade or not?—I believe that an abundant supply of water may be obtained for manufacturing purposes at a much less cost than by the whole of the water being purified after the manufacturers respectively have made use of it.

3492*. You think that by having impounding reservoirs, and utilizing the water in a proper manner, a very much larger body of water might be made available and at a less cost than by attempting to purify the waste water from the different manufactories?—Yes; my scheme would be to have reservoirs, and to pass down water in a pipe of 18 inches or 2 feet diameter, and that all who required it should take it out and should pay in proportion to the bore, and from that revenue the expense of the construction and management of the reservoir should be paid.

3493*. You have stated that for one purpose you are using 100,000 gallons of water a day. At Dewsbury they are paying willingly 6*d.* per 1,000 gallons, that would be 50*s.* a day for that volume of water?—Yes.

3494*. Would it be worth your while to pay 50*s.* a day for an absolutely pure soft water?—No, not for the purpose which I have spoken of.

3495*. But for some selected purposes it might be worth it?—Most decidedly it would.

3496*. Those would be very costly waterworks indeed which would not get a large income by the sale of water at 6*d.* per 1,000 gallons?—It is undoubtedly a very large price for manufacturing purposes.

3497*. Ordinarily 3*d.* per 1,000 gallons is a paying price?—At Dewsbury the source is at double the distance compared with the distance from Huddersfield of the source from which we might obtain a sufficient quantity of water, provided there was not a great opposition in Parliament. The Huddersfield Waterworks Commissioners applied to Parliament last session, and spent a great deal of money and failed in their application. If they could have power without much opposition I fully concur with you that the water would be delivered in Huddersfield at less than 3*d.*

3498*. In this country it is very improbable that a law will ever be passed which will enable one proprietor to take water from another proprietor without arbitration or some fair settlement?—We should give compensation.

3499*. (*Professor Way.*) Your plan of supplying pure water would leave the rivers untouched?—Yes.

3500*. And any people who suffer at the present moment, in districts lying out of your reach, from impurities thrown into the river, would still suffer?—But the arrangement of reservoirs taken in connexion with a prohibition against throwing in any solid matter into the river would greatly relieve the nuisance, and I do not think that the health of the district suffers from the river being polluted. I am aware that some evidence to that effect has been given, but I do not think it has been correct.

3501*. Do you imagine that it would cost any very large sum to purify the water which you use, anything

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like 500*l.* or 1,000*l.*, or even 2,000*l.*?—You must take into account that many premises have not the room.

3502*. (*Chairman.*) If persons can afford to pay anything like 6*d.* per 1,000 gallons for pure water there would be a very wide margin for profit after treating waste water by chemical means with a view to purification?—Just so.

3503*. (*Professor Way.*) And you gain two objects at the same time; you get water for your own use and you get the river purified?—Yes, you leave the water for the district pure.

The witness withdrew.

Adjourned to to-morrow at half-past 10 o'clock.

Huddersfield, Friday, 26th October 1866.

PRESENT:

ROBERT RAWLINSON, ESQ., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, Esq. | Professor JOHN THOMAS WAY.

Mr. H. Brooke.

Mr. HENRY BROOKE (Huddersfield) examined.

3504. (*Chairman.*) What class of mill is yours?—For woollen manufactures; our mills are called the Bradley Mills, a mile below the town.

3505. On the banks of a stream?—Yes, the Colne.

3506. How many hands do you employ?—About 200.

3507. What power do you use?—Steam and water.

3508. What proportion of power do you obtain from water?—I believe we have on an average about 50-horse power; we have three water wheels.

3509. How long have you used water power?—Ever since the mills have been built, 40 years ago.

3510. Do you not find any shortness of water?—There is a short supply at times, and we get very little.

3511. Is the power as steady and as useful as when you first put it up?—Quite so, and we should not like to be without it.

3512. Have any impounding reservoirs been constructed at the head of the valley since your mills were established?—Yes.

3513. The Holmfirth Reservoirs and others?—Yes.

3514. Do they turn down the stream in a steadier volume of water?—They do; they collect the water fresh and turn it out gradually.

3515. Do you dye?—We do, every day.

3516. Have you any supply of water other than from the rivers or streams?—Yes, we have a bore of water from the canal as well.

3517. A bore hole into the subsoil?—Yes.

3518. What depth is that?—I believe it is from 70 to 80 yards deep.

3519. When was that put down?—20 years ago.

3520. Of what quality is that water as compared with river water?—It is hard; we filter the river water and mix the two for dyeing purposes.

3521. Have you had a chemical analysis made of the separate and the mixed waters?—We had. The river water mixed with the pump water is softer than the pump water.

3522. What weight of coals do you burn in a year?—Over 40 tons a week.

3523. What is done with the ashes?—Part of them go into the river; we have a place where we put them, and when they rise above a certain level they go over into the river, and part of them are put on the roads.

3524. Are there any mills situated above you?—Yes, there are a large number on the streams above.

3525. And below as well?—Yes.

3526. What is the custom of your neighbours above you; have you reason to believe that they let the ashes go into the river?—I believe everything goes in; the river is made the receptacle for every filth they make.

3527. Not only dye refuse, but spare ashes?—Yes, and materials from excavations and everything.

3528. Supposing that it was considered necessary for the benefit of the wool trade in the district to put the river under a Conservancy Board, would you personally object to being brought under regulations to prevent your passing solids into the river?—I should be pleased to come under such regulations if they were made general, and I believe such a measure would be of great advantage to the trade of the district as well as to health.

3529. Has the bed of the river been raised by accumulations since you can recollect it?—Yes, it has risen; and I can give you a strong proof of it. Within the last two years we put in a new water-wheel; one of the old ones had got broken, and we had to put in a new wheel, and found that the new wheel must be 12 inches in diameter less than the old wheel in consequence of the bed of the river having been raised through excavated materials, and other heavy matters which had been placed there.

3530. Could you not get a tail flow capable of working a wheel larger than that?—We could not put a wheel in of the same dimensions as before without continually leaping in tail water.

3531. If you attempted to level the river in order to get the tail water cleared away, would it cost you more than the additional power would be worth?—Yes; and the bed would soon be filled up again under present circumstances.

3532. Have you a lodge at your mill?—Yes; a lodge or fore bay; it is a goit half a mile long; we draw from that, and so the water comes to the wheels at a higher level.

3533. You avail yourself of the river to work your power?—Yes; we pay to the reservoir company on an 18 feet 6 fall, but we have not so much now.

3534. Have you ever to cleanse the silt out of that goit?—Yes; the silt is very heavy and we cleanse the goit two or three times a year; the work takes about three days and occupies 16 or 18 men; the refuse goes into the river.

3535. As you are put to this serious cost, has it occurred to you what might be done with this mud?—We think that if the mills above us were made to put in only what was proper we should have much less of this flushing to do than we have at present, and we should not object to cart it out if the same was also done by our neighbours.

3536. If you had only the river water to deal with you would face the cost of maintaining your own works in proper order, without damaging the river for others below you?—Yes, and be very glad to do so.

3537. Do the basements of your mills stand in such a position as to suffer any injury from heavy floods?—We have several times, when the water has been very high, suffered, still we are pretty well raised above. When the water is high, we get it into the tepid wells and into the foundations, and the bottom of the basement.

3538. As that is so now, and you have evidence that the bed of the river has been raised from accumulations, if further accumulations take place, would not

the amount of injury you suffer be increased?—Certainly.

3539. The basement of your buildings and the machinery as they are at present situated might be seriously damaged?—Yes; at the present time, when the river is high, we let the basement rooms stand idle until the river falls.

3540. Was that the case when you first began to work at these mills?—They were not first established by us, but it has been the case frequently, and it is getting worse. I believe formerly it was not so bad; it is a fact that we have had to make a drain since we bought the place to take off this water, and put in puddle too.

3541. Do you make much soap waste in washing your cloth?—Yes; and I have got some samples here of the class of stuff that we turn in.

3542. Have you made any arrangement for the purification of it by Messrs. Teall and Company's process?—We shall have that in operation in the latter part of next week.

3543. Up to this time the refuse has gone into the river?—Yes, and it is going in now.

3544. From this time you expect that you will be able to keep a considerable part of that refuse out of the river?—No doubt, or the man who has agreed to take it will be a heavy loser in putting up the work himself.

3545. Is it the waste from the wool that you are about to preserve?—It is the waste from the cleansing of the cloth.

3546. (*Professor Way.*) Do not you cleanse the wool?—Yes; but that waste still runs into the river.

3547. You do not use soap enough to make it worth while to purify it?—We do not use soap in cleansing the wool.

3548. Did you hear the evidence given yesterday by Mr. Abbey?—Yes, I did. No doubt there are some small inaccuracies in the report which Mr. Abbey read, but, generally speaking, it is a very good and truthful one.

3549. Those inaccuracies may be rectified by a little examination?—Yes, but they amount to very little.

3550. What amount of water do you stipulate for from the impounding reservoirs to come down daily?—I have no idea.

3551. What do you pay for the quantity supplied to you?—Yes, we pay to the Reservoir Company, the Mill Owners Company, about 19*l.* a year; to the Holmfirth Reservoirs; and I think about from 9*l.* to 10*l.* to the Wessenden Reservoir Company.

3552. You purchase the water and the Reservoir Company's stipulated volume of water is let out to be used by all the mills in succession one after the other, according to their power or according to the fall?—Yes; each mill pays according to the number of feet of fall; the mills higher up pay a higher rate.

3553. You have the water in succession as it comes from one mill to the other?—Yes.

3554. I presume you make a private arrangement for impounding or letting the water go?—Exactly.

3555. When you have emptied your goit and cleansed it you are able then to prevent the volume of water passing so quickly as it would otherwise do down to your neighbours?—Yes, and of course the larger the reserve the longer we can hold the water.

3556. Do you buy water for dyeing or washing purposes?—Yes, from the canal company.

3557. Are you satisfied with that water?—No, I am not.

3558. It is not so clean as you would like it?—Nothing like it, and it is partially filtered too.

3559. Does it come from the broad canal?—Yes, the one below the town, the canal basin.

3560. If waterworks were carried out on a larger scale, and a pure supply brought down at a moderate cost, is it probable that you would use that water for washing or for dyeing purposes?—Yes; we should be glad to get the best water we could. I think it is very possible and quite practicable, that we could each use our own refuse water, so that all might find the clean water sufficient for cleansing purposes without taking the canal water.

3561. Do you know anything of the water supplied to the town of Huddersfield by the company?—Not much.

3562. Is it sufficiently abundant for the wants of the population?—Nothing like it; in a dry season, for instance, last year, my father went for three weeks without getting a drop.

3563. During that time the persons who relied upon that supply would suffer considerable inconvenience?—Yes, and they had to cart it from other places for domestic purposes.

3564. If your father, being in good circumstances, suffered in that way, I suppose the poor would suffer to a still greater extent?—Certainly; but the town generally would not be so short as he was; his house stands a little high, and perhaps the mains are not sufficient, they are only turned on partially for an hour at a time, and the water perhaps did not rise to the height of his house before it was drawn away to places in the town; we never have it on for more than an hour or an hour and a half in a day.

3565. Have you seen any of the works where purification has been attempted?—I have not.

3566. Mr. Abbey mentioned some mills at a place called Shepley?—Yes, I have heard of them.

3567. Have you drawn any conclusions from what you have heard?—I fancy that all mills could not purify water in the way that those two mills have, because all mills have not a sufficient lift, or sufficient land on to which they could pump it.

3568. If there is to be a general purification different modes must be resorted to, adapted to the peculiar circumstances of each case?—Yes. If all mills had a lift, as in the case of the two mills which Mr. Abbey mentioned, the water could be purified and again used by the party who had it. We used to do so to a fair extent, and by pumping this water on to the grass land we grew almost double crops of grass.

3569. What quantity of water do you use for dyeing and washing purposes?—I cannot tell; but Mr. Abbey calculated the amount we should use from the pans.

3570. What weight of wool do you pass through your mills in a year?—The wool would average about 800 pounds a day and other materials of course in addition—mungoes, and so on.

3571. Do you know what weight the whole would be?—No, but it would be a very great deal.

3572. You do not wash the mungoes?—No; the mungo is washed in the cloth.

3573. (*Mr. Harrison.*) The mungo goes through all the processes, except wool washing in the first instance?—Yes.

3574. (*Chairman.*) Have you considered the mode in which prevention of pollution might be carried out?—I believe that we could purify the water before turning it back into the river from the scouring vats. I believe, that if we are compelled to keep the foul water out of the river, science will bring out something that will enable us to purify the water at a small expense and in a small compass. I think it would be easy to do the thing if we set about it.

3575. The next question will be as to the jurisdiction or authority that should exercise power over the whole district, so as to see that each manufacturer obeyed the law, do you think there should be a local board?—I think first that there should be local boards and then that there should be some head board, taking in the whole watershed of this district. I should like it to be made compulsory for every man to carry out purification.

3576. You would not approve of a Government board to sit in London and appoint officers to come here and exercise control over you?—No; I think it would be more practicable for the matter first to go through a local board, and if it could not be carried out, then it should be referred to a higher power.

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3577. Have you attempted to prevent the smoke nuisance at your mills?—We did at the mill at Holmfirth, 10 or 12 years ago, and prevented a great deal of nuisance from the smoke, but we had burnt our boiler through rather quickly, and besides, the principle was not a profitable one.

3578. Did you use a patent apparatus?—Yes.

3579. (*Mr. Harrison.*) I understand that you pay to the reservoir companies a certain sum for the water as power?—Exactly so, only for power.

3580. Therefore you are interested in the water from the time it leaves the reservoir?—Yes.

3581. If the mills intermediate between you and the reservoir were to divert the dye and other waters on to the land that would diminish your power?—Certainly.

3582. And to that you would object?—If the quantity diverted were great we should.

3583. That mode of purification probably will not be carried out?—I hope not. I would prefer that chemistry should do something to purify the water at a small expense. A few hundred thousand gallons would not be much for a man to purify, but it is a great deal if it is turned into a stream; one small drop does a great deal of harm.

3584. You would have the restrictive power extend to all refuse from mills, whether ashes or spent dyewoods, or pollution caused by the dyeing process and soapsuds?—Yes, exactly.

3585. You would be willing to comply with such restrictions if every other manufacturer was obliged also to do the same?—Yes, I think it would be advantageous to the trade generally, provided it were only a small cost that we were put to; we should be all gainers by having pure water of a bright colour.

3586. You think it is possible to obtain such water?—Yes, I think so, and very easily.

3587. (*Chairman.*) At all events it is quite possible to try to do it?—Yes, and I think it is very easy to be done.

3588. Have you ever tried any experiment yourself?—Yes, we have had river water purified.

3589. By what means?—At the present time we filter the water that we pump from the river for dyeing purposes to a certain extent and use it again; it would not pay us to purify it all.

3590. (*Professor Way.*) You take the river water and try to purify it?—Yes, and then turn it back into the river.

3591. (*Mr. Harrison.*) Is that process successful?—The water is much better.

3592. (*Chairman.*) Filtering by sand for manufacturing purposes, as bleaching and paper making, is certainly more than 40 years old?—It is a common thing here to filter water for dyeing purposes now.

3593. It requires a considerable area of ground?—Yes, it does. Some parties are filtering for dyeing purposes and not for cleansing.

3594. There should be not less than a square yard for each 500 gallons per day?—I think it would require quite that; but I think filtration can be done by a much better process than by sand.

3595. (*Mr. Harrison.*) From the returns of mortality there appear to be five divisions in Huddersfield; in which of those are your mills?—We are not connected with any of them. We are in the parish of Dalton, although the mills are called the Bradley Mills. There are about 30 cottages, and the mortality there has been very great, especially amongst children.

3596. The mortality appears to have been strikingly different in the different districts. The average mortality during the five months ending December 31, 1865, was at Bradley only 12 per 1,000. At Dalton it was 56 per 1,000, and throughout the whole return a similar kind of difference exists. Can you account for that very great disproportion?—I cannot.

3597. (*Chairman.*) I think you stated that you could not remember what the Wessenden Company charge a year per footfall per horse-power?—I think it is something like 24*s.* I may say that out of this lodge of ours some of our neighbours draw water, and therefore that reduces the charge to us from what it would be.

3598. I see that the company are empowered to charge 25*s.*, but you think the present rate is 24*s.*?—Yes.

3599. (*Professor Way.*) I understood you to say that if water used by manufacturers underwent a process for separation of all objectionable matter, and was then thrown into the river, the water of the river would be suitable for manufacturing purposes?—Yes, I believe so.

3600. You would hardly expect chemistry to extract all the salts from the water which had been thrown in?—I think it would take out a very large proportion.

3601. In all probability the colouring matters are in suspension?—I think so.

3602. As to the lime and salts which are thrown in, would they be objectionable if left to be mixed with the river water?—No, not for cleansing purposes. If the colouring matter was taken out we could then use other things, soaps and so on, that would counteract those salts.

3603. We know that the water you receive from Holmfirth and Wissenden is very soft?—Yes.

3604. In a process of purification where chemicals are employed the water will naturally get harder?—Yes.

3605. After separating the colouring matter and the solid matter in suspension the hardness may be increased, and you may not be able to remove it?—Just so.

3606. Is the water so cleansed likely to be very hard considering its volume?—I do not think so.

3607. The hardness of the water would not be an absolute impediment to its use for washing and cleansing purposes?—No; we prefer soft water. Every particle of dirt taken out would make the water so much better than it is now.

3608. If tolerably bright and without colour, and not of extreme hardness, the water would be suitable for your purpose?—Yes.

3609. And that you believe can be accomplished at a reasonable cost by chemical means?—I think so. I believe that chemical science will soon invent something that will accomplish that.

3610. If you are obliged to seek for it?—Just so. At the present time we are obliged to seek for nothing, and we make the easiest matter we can of it. It is of no use for one man to attempt to do otherwise unless all are compelled to do so too.

3611. Supposing the process required subsiding tanks in which the water used in one day should be stored for deposit with alternate tanks to fill on alternate days, do you think that it would be practicable in a majority of the mills?—I think so, unless they were large tanks. If they were large tanks it would not be possible without getting more ground. We could do it very well.

3612. Have you a larger space of ground than the majority of mills?—I think we have more than other mills generally, but some have a larger space than we have.

3613. I suppose it is desirable to deal with the liquid as it comes by mechanical filtration?—Yes, to clean it as it comes, and clean it as it goes.

3614. So as not to have to store it?—Yes.

3615. (*Chairman.*) You stated that you had brought some samples of the water here?—Yes. This is a sample (*handing in the same*) from the washing of wool. There has been no soap used there at all.

3616. (*Professor Way.*) Has anything else been used?—A little ammonia.

3617. And urine?—Yes, that is all.

3618. Was it carbonate of ammonia?—No, soda-ash partly and other things.

3619. Do you mix ammonia with soda-ash?—Yes.

3620. Then it is sulphate of ammonia?—It is principally soda-ash and urine.

3621. Do you use any substitute for urine?—Yes, soda-ash is one of the substitutes. We keep a man

continually collecting urine, and we mix the two. We put a little in the vat where we raise the scour before the wool is washed.

3622. If you used soda in any quantity would not that injure the fibre?—Yes.

3623. Why do you not use soap?—Because it is too expensive.

3624. Otherwise, I suppose, soap would be the best thing to use?—Yes.

3625. Just some before and some after?—Yes; we use soap when we come to the cloth.

3626. Is it only human urine that has been used?—Yes.

3627. No pig's urine?—No. We sometimes use it for the cloth, but not for the wool. We employ a man and a horse and cart continually collecting urine. We get two or three large barrels a day containing three-quarters of a ton each. This bottle (*pointing to the same*) contains the water from black dye. The first sample goes into the river when we have done with it.

3628. Is there any reason why it should be kept out?—It would grow large quantities of grass if it could be pumped on to land.

3629. Has it grown large quantities?—Yes.

3630. I understand that this bottle (*pointing to the same*) contains water in which wool has been steeped and washed?—Yes; the wool is first steeped in the tank, and then it is put into the wash, and there knocked about with a long stick, and then they let the water out and let another wash through, and so wash the wool a second time.

3631. There is a soaking vat and a washing vat?—Yes.

3632. Is a large quantity of water put in?—Yes, a very large quantity. I think there would be half a ton of water to something like 50 pounds of wool; including the two washes there would be about three quarters of a ton to a ton, but there is a great difference. Some people use much more water than others. To 50 pounds of wool something like a ton of water is used.

3633. Nothing more is done to the wool?—No, it is then dyed. That (*pointing to the bottle*) is from the black dye, logwood, cam-wood, and iron and copperas.

3634. It is possible that this refuse water would not filter readily as it is, but that by some chemical treatment it might be made to filter?—I think so, but that is merely my opinion.

3635. Would this black refuse become absolutely colourless by subsidence?—Yes, I think so. It is bright at the top now.

3636. This (*pointing to the bottle*) is a specimen from only one kind of vat?—That is the black and the worst I consider.

3637. (*Chairman.*) This is from the beck, is it not?—No, that is from the vat before it runs into the beck. This bottle (*pointing to the same*) contains water from the washing machines, from the washing of cloth, and this (*pointing to the same*) is that for which we are now putting up an apparatus in order to get the greasy matter out.

3638. What is the quantity of that black refuse which is passed into the river?—Mr. Abbey, I think, has calculated it at 1,425 gallons.

3639. (*Professor Way.*) Does that come direct from the vats?—Yes.

3640. How much more would the water that is used to wash with amount to?—Twenty times as much.

3641. The first of that water is of course bad?—Yes. We do not wash the wool after it comes out of it; we do not wash it, not until it is made into cloth. Some people do, but we do not.

3642. 1,400 gallons in round numbers is all that you have to discharge of dye water?—Yes.

3643. To what quantity of wool would that water be applied?—We use about 800 pounds of white wool per day to 1,400 gallons of water.

3644. Then what is done with the wool after that?—After that the wool is dyed and scrabbled, and made into cloth, and then when it comes out of the loom it is cleansed.

3645. (*Chairman.*) Are you to receive a lump sum from Messrs. Teall and Company for this refuse?—So much a year.

3646. According to the quantity of material they extract from it?—No, they offered a certain price. We did not know what they would make out of the bargain, and we thought it better to accept their offer than to let the refuse go into the river.

3647. (*Professor Way.*) In your arrangement with these gentlemen have they put any restriction upon you as to the quantity you are to supply them with?—No, they merely take what we make.

3648. Do they take only the washing after the first process?—Just the washing from the cloth.

3649. Do they take away all the water that you use in washing the cloth?—Yes.

3650. You throw none of the soap into the river?—None.

3651. Nor the grease after the cloth is made?—No.

3652. In other districts we have been informed that Messrs. Teall and Company do not take away all the water?—They are putting up an apparatus at the place where they get the water, and they will deal with all of it there.

3653. In other places the practice is this, that at a certain time when the water begins to get purer, containing less soap and grease, it is passed into the river without being taken by Messrs. Teall?—They will deal with all of that.

3654. Has sufficient experience been gained to justify you in thinking that they will be successful?—I do not know.

3655. Is their apparatus at work in other places?—Yes.

3656. You have not seen the liquid that follows after their process has been applied?—No, it is not working yet with us.

3657. If Messrs. Teall's process for extracting grease could be improved so as to take out this colouring matter (*pointing to a bottle*), do you think it might be fairly insisted upon?—The party who has contracted with us says that the water will leave his cisterns comparatively pure, so that if the water is then put into a bottle you will see no colouring matter in it. He says that it will have a yellow tinge and nothing more.

3658. You have stated, I think, that to use dye water on land would be perhaps the best way of getting rid of it if it were possible for all persons so to deal with it?—I believe that if the first sample of water that I produced could be put on to land the land would grow a double crop of grass, and anyone would make a large profit by it.

3659. Suppose that a manufacturer at one spot had no land upon which he could so use it, do you think it would be possible for the occupiers of 10 or 20 mills to combine and so to deal with it?—I cannot say. I believe that the majority of manufacturers would not have the opportunity of placing it on land, only a few of them would. I believe that some chemical process could be adopted, and that would be safer than having the refuse pumped on to land.

3660. You believe that these different samples might be chemically dealt with it?—Yes. This bottle (*handing in the same*) is a sample of the river water as it was on Wednesday, after very much rain had fallen, and when there was a very large flow of water.

3661. (*Mr. Harrison.*) Have the parties to whom you sell this soap refuse any power over the quantity that is delivered into their tank?—None at all.

3662. From the evidence we have received in other cases it appears that the man in charge of the cleansing process is paid so much a year to turn the refuse off at a certain point?—I believe that all ours will run into one tank, and then be run into other tanks.

3663. That appears to be the usual system?—That is

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the way in which the person with whom we have contracted is doing it. All the water from these machines will run into the first tank, and be pumped out of that into others.

3664. He cannot divert the water. You send it away into his tank, and to that tank it must go?—Yes, just so; but when the tank is full the liquid will of course run away, and so there will be a great loss to him.

3665. (*Professor Way.*) Will you be kind enough to furnish the Commissioners with samples of these four waters in large quantities?—Yes.

3666. (*Chairman.*) Has any litigation taken place that you are aware of with regard to passing solids into the river?—Yes.

3667. Can you mention any special instances?—Yes; we have been summoned for doing it.

3668. Who summoned you?—A neighbour above us. We had put ashes in, and he summoned us to the county court for doing so. He alleged that by doing so we were raising the bed of the river and throwing his wheel into back water. We went on thinking that it was merely a personal matter as he had not taken notice of our neighbours, and we thought that we should be able to set up a prescriptive right, because we had done it so long. However, he showed us in the county court that there was no right to do it.

3669. You had a restraining power exercised over you?—Yes; we were fined 5*l.*, and the judge stated that it was the lowest fine he could inflict, but that if we were brought there again the fine would be 50*l.*

3670. Then the common law of the land, it appears, is strong enough to reach that form of pollution?—Yes, I have no doubt of that.

3671. But to put the machinery in motion one neighbour must summon another?—Yes. At my instance a meeting was called at the "George Inn," Huddersfield, to consider whether we could not put a stop to this practice, and then everybody, or the few who attended, appeared to feel that any person who might be proceeded against would think it a personal thing, and so the attempt ended in nothing. I offered with five others to pay men to walk the banks just to see who did put in this heavy matter, and then summon them, but we did not succeed. That was in 1865. Sir John Ramsden's agent met us most fairly, and promised to do anything he could. At that time all the excavated materials were put into the river at the Long Bridge, which he stopped.

3672. Are you aware that from the mills in the Lockwood Road the ashes are systematically put into the river?—Yes, it is generally so with them, whether they pay water rates or not.

3673. Every person riding along the road can see it?—Yes; you can see it at nearly all the mills.

3674. Have any proceedings been taken against those persons?—I have not heard of any excepting our own case.

The witness withdrew.

The witness subsequently informed the Commission that he had been mistaken in stating that the whole of his waste water was subjected to the process of soap extraction, that after giving his evidence he found that Messrs. Teall and Company, though at liberty to take the whole for that purpose, did in fact treat only the richer part, and was in the habit of shutting out the water from their tank as soon as they found it beginning to run bright.

Mr. S. Armitage.

Mr. Samuel Armitage examined.

3675. (*Chairman.*) Are you a mill owner?—Yes.

3676. Is yours a woollen mill?—Yes.

3677. For washing wool and dyeing it?—Yes. I am not a manufacturer at present; I am out of the business, and I let the mill to my sons.

3678. Where is the mill situated?—At Shepley.

3679. Upon what stream?—Upon a tributary to the river Calder; I do not know that it has any particular name.

3680. What number of hands are employed at the mill?—From 250 to 300.

3681. Do you know what weight of wool is dealt with?—Not exactly.

3682. Is dyeing carried on there?—Yes.

3683. Is much water used?—Yes.

3684. Where is the water obtained from?—From some driftings and a boring we have made ourselves upon our own property; the water rises there.

3685. You take water from drifts and borings on your own property?—Yes.

3686. Is it hard or soft water?—Neither very hard nor very soft.

3687. Is there any ochre in it?—No.

3688. Have you any idea what volume the boring produces in 24 hours?—About the flow of a two-inch pipe.

3689. What pressure is upon it?—Just a fair pressure.

3690. Four or five feet?—Yes.

3691. Is the water constantly flowing?—We have reserves to collect it in wet seasons, and we use these reserves in dry seasons; there is not so much flow in a dry season.

3692. Is your mill described in Mr. Abbey's list of mills?—Yes, I believe he looked it over.

3693. When the water has been used for washing purposes, is it very much polluted?—Yes.

3694. Is it of the colour of any of the samples in the bottles before you?—It is very similar to this (*pointing to a bottle*) I mean after the scouring of the wool, and it is similar to this (*pointing to another bottle*) after the cloth has been dyed.

3695. May we take it that these samples would represent fairly samples of water from your works?—Yes.

3696. What did you do with that water after it had passed from your premises?—It used to run into the stream to join the river Calder, but lately we have pumped it up on to some dry meadow land.

3697. What kind of property is below you?—There are other mills below.

3698. Does the refuse from your mill find its way into any ornamental property?—No.

3699. Did it flow into natural watercourses below, and have you had an action brought against you for fouling the water?—Yes.

3700. Why were proceedings commenced against you?—The owner of the adjoining property said that the refuse from my mill was injuring his property, and he would not permit it.

3701. Who was he?—Mr. Edward Hardy of Shepley.

3702. He owned the land but did not live upon it?—No, he lets it for farm purposes and not for mill purposes at present.

3703. He considered that your refuse injured his land for farming purposes?—Yes; and he said that the cattle would not drink the water. That was the ground of his complaint against us.

3704. How long is it since that action was commenced?—About five years ago.

3705. Did you defend it?—Yes.

3706. Where was it tried?—At York.

3707. What was the result?—A verdict for the plaintiff was submitted to on condition that the works were not to be stopped and the water was to be polluted as little as possible.

3708. You were required to use such means as were available to purify the water?—Yes.

3709. What means did you use?—We put down a tank to collect all the foul water from our works, we then put down a pump and pumped the water up on some dry land.

3710. What height was the lift?—I do not know

the exact height, but there are about 15 acres of land that the liquid runs over.

3711. Are there 50 feet or 100 feet of lift?—Not quite 50; I should think perhaps 30 feet.

3712. Do you know what size the pump is?—It is a four-inch pipe.

3713. You have a tank in which to store the refuse water and that process goes on eight or 10 hours a day?—Yes, all the time the mill is going; the tank is not always full.

3714. Do you put the water on summer and winter, in wet weather and dry, and in frost and snow?—Yes, continuously day by day.

3715. Do you find that purification takes places as continuously as you put the refuse on?—Yes, but we have to keep changing the spots to which we apply it or it is very injurious to the land.

3716. I suppose it would make a swamp?—It eats the grass off.

3717. You use judgment and care in what you do?—Yes.

3718. If you apply it with judgment and care what are the results?—The land produces much more grass.

3719. Will the cows eat the grass so produced just as readily as other grass?—Yes.

3720. Does the grass produce as good milk or as good butter?—Yes.

3721. And as good hay?—Yes; a little coarser.

3722. What you grow are the natural grasses of the land?—Yes, the fine grasses all disappear.

3723. Have you tried to grow Italian rye grass with it?—No.

3724. The natural grasses have been fostered by the application of this refuse?—Yes.

3725. You have been contented with that amount of success?—Yes, we are quite contented, only I should say that we have to change the liquid; after the liquid has been run on for a couple of years or so it requires a change, a little gas lime from the gas-works will very much improve it.

3726. You have not tried artificial grasses?—No.

3727. Have you tried green crops, turnips or mangolds?—No, and I fear it would not answer for them.

3728. How many acres do you say you have operated upon?—From 15 to 18.

3729. This refuse has been more or less put upon them all?—Yes, ours is very dry land, and I fear the process would not answer on land that required draining. I believe it would not answer, the liquid would get into the drains and run away.

3730. Should you be surprised to hear that heavy clay is a very good disinfectant and purifier, perhaps better than sand?—If there were no drains then the process might do better, but where we have drains we must keep the liquid out of that part.

3731. Because you think it would filter through too fast?—Yes, it gets into the drains and so passes into a little beck.

3732. Your object is that it should combine with the earth, and that the earth should take out the colouring matter?—Yes.

3733. Do you see the water as it comes out?—No, we never see it any more, or hear at all of it.

3734. Does the process pay you for the trouble you take?—No, and I would not take the trouble if it was not that we have been compelled, for what with the expense of pumping, and the pump getting out of order, and the pipes filling up, the liquid is not worth saving; I think perhaps that it may just pay the cost.

3735. The irrigation cannot be done without attention?—No; every day and day by day.

3736. Does it entail any actual loss upon you?—No, I believe that the extra quantity of grass produced will pay for the expense.

3737. If you balance the accounts fairly you may say that?—Yes.

3738. You have to give attention and care and take a little trouble which does not cost money?—Yes.

3739. If you had to perform the operation for any other person, and you charged your time for it, there would be a loss to that person?—Yes.

3740. Your mill is exceptionally situated in having this area of land?—Yes.

3741. As you came nearer to the town and within it where mills are differently situated the mode you adopt would not be available?—I believe not.

3742. If the water is to be purified, it must be brought within a much narrower compass?—Yes.

3743. As land has the effect of clarifying and brightening the water, I suppose we may expect that chemistry might discover something more compact, which would have a similar effect?—I believe so; but I very much doubt whether the water could be made entirely pure by chemistry; we tried to filter it after the action was commenced against us, but for such a quantity as that filtration did not answer, the refuse closed the filter.

3744. Did you try the double process, deposition first, and then filtration?—No, we let the liquid come from our works right on to the filter.

3745. Then I suppose it would cover the sand over as with a film of gutta percha?—Yes, the filter got choked up.

3746. You did not try an intervening tank in which to deposit the solids?—No.

3747. You do not know therefore what effect might be produced by the double process?—No, I do not.

3748. Have any other persons in the district within your knowledge been dealt with as you have been?—Yes.

3749. Who are they?—Messrs. Barnacott and Kenyon.

3750. Whereabout are their works?—A little below ours.

3751. How long have you known the streams of this district?—For the last 30 years.

3752. And you have seen the pollution gradually going on?—Yes.

3753. Have you formed any opinion as to whether it is necessary to institute proceedings to prevent this pollution?—It is quite necessary; it is very important that something should be done.

3754. I suppose the manufacturers who carry on trade in this district came here principally to avail themselves of the water?—Yes.

3755. Of pure water as it was in the first instance?—Yes.

3756. As trade has increased by the use of the water, the abuse and neglect which have been carried on have now destroyed the water?—Quite so, and the condition of the water is also very injurious to the health of the public living in places through which the stream passes.

3757. Can you give us any idea of what would be the difference in the cost of cartage or conveyance of material to and from your works as compared with works situated in the town or nearer to railways and highways?—We have some little advantage in the case of coal, being very near to the pit, and we have always thought that one would balance the other.

3758. Do you get labour any cheaper?—No, it is much the same with us. Wages are regulated by the same scale throughout the district.

3759. I suppose there is a difference in proportion, as a mill is favourably or unfavourably situated; for example, to some mills there is a considerable ascent?—Yes.

3760. The cartage of wool to those mills would be a little more expensive?—Yes, but the difference would be so small that it could hardly be reckoned in the cloth.

3761. Supposing an equitable rate was laid upon mills in the whole of the district that would be benefited by preventing pollution of the river; do you think it need be a rate so oppressive to trade that trade could not bear it?—No; I think that the trade would be able to bear a fair rate with a view to improving the condition of the river.

3762. If the work were carried out carefully and economically?—Yes.

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3763. Do you wash your cloth as Mr. Brook described with soap?—Our cloth is precisely the same, but our dyeworks are not large enough. Dyeing is mostly done off the premises.

3764. Do you think the soap in your refuse washing it would pay for being extracted?—Yes.

3765. Do you do that?—No.

3766. Will you do so?—Yes, if if we get an offer that will make it worth our while; if not, I think the soapsuds had better go with the other liquid on to the land.

3767. If any restriction could be put upon all manufacturers from pouring foul matter into the river, do you think that they had better be left to their own devices to carry out such plans as they might find easiest and cheapest?—Perhaps we should object to being put to a small expense.

3768. (*Professor Way.*) You might be glad of any assistance or suggestion, but you think everybody ought to be left to do it in his own way, so long as in the result purification is done according to a certain standard?—Yes, that would be quite right.

3769. I take it that the liquids you pump on to the land are, if carefully applied, beneficial to grass generally?—Yes.

3770. You say that if the liquid is left too long on one spot, it is apt to destroy the grass?—Yes, it will eat it off.

3771. Would that not be the case with water if left too long on the land?—No, I believe that clean water may be allowed to run on for many years without ever seeming to eat the grass off; it rather makes grass grow more.

3772. You have 18 acres of land?—From 15 to 18.

3773. How long does this stuff run on at a time?—For not more than two or three days at once, and then it is shifted and carried on to another part.

3774. It is the same in the case of sewage, where there is no manufacturing refuse sewage, is run on for three or four days, and then shifted?—Yes.

3775. When so treated it does not injure the grass, except so far as destroying the feeble grasses?—Yes, the white clover and fine grasses all disappear.

3776. (*Mr. Harrison.*) Can you collect any of the water that runs off the land, or is it all soaked in?—It is all soaked in. We are obliged to have places for the liquor to be pumped up to on the land so as to make the thick part settle down. Only the very thin part is run on to the land, for we find that the stronger part of it is not so good for the land.

3777. (*Chairman.*) The colouring matter?—Yes; we mix that up with some other things, and let it lie awhile.

3778. (*Professor Way.*) Supposing there were mills below you having water power, and you pumped large quantities instead of the small quantity that you do pump on to the land, and it disappeared; is there any certainty that the liquid would find its way into the river again above those mills?—I believe it is so filtered by the land that when it appears again it is quite clear.

3779. Do you feel certain that it would get into the river again above the next mill power so as to be useable by the mill next below you?—I believe that they could not use it again.

3780. You say that this water disappears altogether?—Yes.

3781. Where do you suppose it goes to?—Into the rock.

3782. Does it ever get into the river again?—It may, but I have no idea where.

3783. If there was a large quantity of it, and it found its way down to a point below the mills below you there might be a question as to your right so to divert the water?—Yes, decidedly; but the water all rising upon our own property, we use it all at times, and not any leaves our place during a dry season.

3784. I understood you to say that you sent all your refuse water on to the land, both the dye water, and that which contained oil and grease?—Yes.

3785. Do you now propose to extract the oil and grease?—Yes.

3786. You are probably aware that acid is put into the dye water after it leaves the tanks, so that the oil and grease may be extracted?—I was not aware of what was done to extract them.

3787. If there was acid in that water, what effect would it have on the land?—I fear that it would not do well for the land.

3788. Should you suppose that dye water sent upon land without soap would not injure the land?—I should fear that some dye water would injure it very much.

3789. (*Chairman.*) If the soap was extracted?—Yes.

3790. You now send on the land all the water as it comes to you?—Yes.

3791. Therefore it does not receive further dilution. You send it away just as it passes from your vats?—Yes.

3792. Have you noticed whether the application is more or less beneficial in dry or wet seasons of the year?—In a wet season it will answer better than in a very dry season.

3793. Shoving that by dilution it is more beneficial?—Yes, in a very dry season it appears to do harm.

3794. If there was a stream from which you could pump an additional volume of water into the liquid so as to dilute it, the effect of the application would be as beneficial in dry weather as in wet weather?—I believe so.

3795. (*Professor Way.*) In the same way, if dye water is only prevented from being injurious by admixture with soap, you believe that it is the dilution from the soapsuds that is the cause of the dye water ceasing to be injurious?—I believe so.

3796. The dye water, if you could mix river water with it, would not be injurious even if there was no soap with it?—It might not, but I believe the dye of itself would be very injurious.

3797. (*Chairman.*) You mean dye water of the strength as it comes from your vat?—Yes.

3798. But of the effect of dye mixed with a larger quantity of water you have had no experience?—No.

3799. (*Professor Way.*) Is it a fact that strong urine would destroy these pernicious qualities?—Yes, urine is very beneficial for land.

3800. Undiluted?—Yes, if it is not diluted, and only put on in very small quantities.

3801. In wet weather?—Yes.

3802. (*Chairman.*) Would not undiluted urine put upon grass-land kill it?—Yes, if too much is put on, but if the urine be put on with a watering can very thin, its effect is wonderful.

3803. I suppose that a solution of guano would kill everything it touched if it were too strong?—Yes.

3804. It is injurious when its strength reaches a proportion which can be ascertained by experiment?—Yes.

3805. (*Professor Way.*) It is not a question whether the dye is injurious *per se;* it is injurious on account of its strength, or its want of dilution?—Yes.

3806. It might injure if strong, but diluted, it might not?—I believe so.

3807. (*Mr. Harrison.*) The result is, that in the case of a town where large manufactures are carried on all this dye refuse might be turned into the public sewers with the sewage of the town, and be carried on to land below the town, and be used there beneficially?—Decidedly.

The witness withdrew.

Mr. Walter Kenyon (Huddersfield) examined.

3808. (*Chairman.*) What business are you concerned in?—Fancy woollen manufacture.

3809. Where is your mill situated?—At Shepley.

3810. Near to the works of the last witness?—A little below him on the stream.

3811. What number of hands do you employ?—About 200.

3812. What kind of power do you use?—Steam power.

3813. What weight of coal do you burn per annum?—Not quite five tons a day.

3814. What do you do with the ashes?—They are accumulated, and we sell them to the town for the purpose of repairing roads.

3815. Are any of the ashes washed into the stream?—None.

3816. Do you wash your cloth and dye it as well?—We dye and wash the cloth.

3817. Is your refuse like the samples on the table?—Yes.

3818. Would this (*pointing to the same*) be a fair sample of the refuse that you turn away?—We do not turn any away.

3819. Do you produce any refuse like these (*pointing to the same*)?—I think those are darker than ours.

3820. What is done with your refuse dye water?—It runs into a tank and then we pump it on to the land.

3821. In the way the last witness said that he did?—Our plan is rather different.

3822. What led you to adopt that mode?—At first, or after we had been at Shepley for nine or twelve months, we were informed that our neighbour was likely to have some unpleasantness, and we made a large filter bed and two swamps, and turned all the refuse water into one swamp, and then it ran over a wall into another swamp, and from that into a filter bed.

3823. By a swamp I presume you mean a settling bed?—Yes.

3824. Where the solids would fall to the bottom by deposition?—Yes, and there the liquid ran out into a filter.

3825. How was the filter made?—With stones and ashes and sand.

3826. What area did it contain?—The swamp was about 65 feet long; the filter bed was 76 feet by 27.

3827. What was the first swamp in width?—About 2 yards in width.

3828. To what depth did you allow the material to accumulate?—About 18 inches.

3829. As the refuse water passed through the depositing tank did fermentation set itself up?—Yes.

3830. Did a scum rise to the surface?—Slightly.

3831. In warm weather did the liquid smell very badly?—No; I cannot say that I noticed it.

3832. Did you see gases rising up in bubbles?—Yes.

3833. How did you arrange your filter?—We put a wall across in this way (*describing*) and we had stones as large again as my fist, and we filled some two or three yards with those stones, and then we put another wall, and after that we put down some small stones, and then some ashes, the roughest we could get, and we put some small ashes in another bed, and then we made a bed of sand.

3834. What thickness of sand?—I think it was a yard thick.

3835. What effect did that filter produce upon the material?—It had an effect until about 3 o'clock in the afternoon or 4; after that the refuse began to accumulate in the filter; it could not get away, it came out and ran over the top into the river.

3836. You mean that it filtered so fast the refuse choked the filtering medium and it then overflowed into the river?—Yes.

3837. As a filter it failed to act?—Yes.

3838. The refuse coated the filtering materials and filled up the pores?—Yes.

3839. While it did act as a filter the whole of the water passed through the bed and came out at the bottom?—Yes.

3840. In what condition was the effluent water?—The water became quite clear, at least our own water did; but when some parties who were cotton dyers situated above us sent down theirs, we could not filter that.

3841. You could not extract the coarser matter?—No.

3842. What did your filtering arrangements cost you?—From 40*l.* to 50*l.*

3843. How long did you attempt to carry on that process?—As soon as we found out that filtration would not answer we put a pump up.

3844. Did you carry on the filtration for a week or a month?—Yes, we tried it for six months.

3845. Then you resorted to another process?—Yes, but we pulled the filter bed up two or three times in order to improve it.

3846. Did you attempt to scrape the surface clean so as to keep up the action of filtering?—Yes, we took out the stones and replaced them with fresh ones.

3847. Was there any filth in the bottom amongst the stones?—Yes, but the liquid did not go away fast enough.

3848. If the filter choked up at 3 o'clock in the day did you get it into condition for a fresh start next day?—Yes, it was all right the next morning.

3849. And you went on repeating that process from day to day?—Yes.

3850. Until you got tired with it?—Yes, and it was so very expensive.

3851. (*Professor Way.*) Did you do nothing to it to make it fit for operation next morning?—No, we did not. We had to clean it out about once a fortnight; first one bed and then another, we took them in rotation.

3852. (*Chairman.*) To what depth did you fill in over the surface of your filter?—I should say we filled it up a yard deep.

3853. The foul water coming upon the top of the sand?—Yes.

3854. Then the fact is that the filter did not filter fast enough?—No, but it filtered very well until 3 o'clock.

3855. It got rid of the material up to that time, and then it began to choke up and the water flowed over?—Yes.

3856. It would go on filtering but too slowly for the make of the water?—Yes.

3857. It was not absolutely choked but the filter was not quick enough for the speed at which the water was made?—Yes.

3858. If you did not scrape the surface the filter would still go on working again the next morning?—Yes.

3859. That showed that you had not area enough, or that the filter was too close?—I think there was not area enough; we had all that we could get there, but it was not enough for us.

3860. (*Professor Way.*) At what time did you start in the morning?—At 6 o'clock.

3861. (*Chairman.*) Supposing you had had two or three more beds of the same size, a double or treble series, do you think you could have gone on better?—I have no doubt of it. If we could have had a filter four times as large I have no doubt that we should have succeeded.

3862. You failed, not because the filtering process was defective, but for want of area?—Yes.

3863. (*Professor Way.*) It appears that out of 12 hours a day you could filter for nine hours?—Yes, but in the afternoon we turned more out from the washing machines than we did in the forepart of the day.

3864. Do you produce more dye waste than Mr. Armitage does?—Yes.

3865. You have 7 acres while he has 20?—Yes.

3866. (*Chairman.*) What do you do with the night soil at the mill?—That is all carted away and put on to land.

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Mr. W. Kenyon.

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3867. Are there privies there?—Yes.

3868. The soil does not go into the river?—No, we turn nothing into the river, except condensed water from the engine.

3869. Could you not put that into the cooling pond, or is that too low?—We do put it there in the height of summer, but there is not sufficient water coming down here (*pointing to the model*) for condensing purposes.

3870. (*Mr. Harrison.*) Does the irrigation cause any foul smell upon the land?—No.

3871. Have any of your neighbours complained of it?—Not one of them.

3872. Having so much land you are favourably situated I suppose; at all the mills they could not do as you can?—No, it would be quite impossible.

3873. If persons not so well situated had actions commenced against them they must do something different from what you have been able to do?—Yes, they would have to try filter beds again.

3874. (*Professor Way.*) Or something as a substitute?—Yes; all the water we use we get from our own land.

3875. (*Chairman.*) You possess an area that would enable you to have put three times the amount of filtering beds that you have?—We could have made them a little larger but not sufficiently so, I think.

3876. (*Mr. Harrison.*) Your experience is that refuse from manufactories similar to yours can be filtered?—Yes, I think so, if they have sufficient area, but there are very few I believe who have sufficient area.

3877. And the refuse could be applied to land with advantage?—Yes, but it is an expense. I do not believe that it pays us for pumping it up.

3878. How many years have you pumped it on to the land?—About four years.

3879. Does the increase in your crops pay for the expense you incur for pumping at the works?—I think not.

3880. Do you think that that arises from your not having a sufficient area upon which to put the refuse?—If we had a larger area I think it would be better for use.

3881. Did you hear the evidence given by Mr. Armitage upon that point?—Yes; we shift the application every morning; a man goes every morning after his breakfast to attend to it.

3882. What quantity of refuse is yours as compared with that from Mr. Armitage's mill?—I think we have more than he has.

3883. To carry it out successfully, according to his evidence, you would require more land than he has?—Yes.

3884. And you have only about one third?—Yes. This stream (*pointing to the same*) is fouled very much with ochrey water from coal pits and water that is pumped out of the pits, and in consequence the water that comes down the stream cannot be applied to any process of manufacturing.

3885. Do they work more than one bed of coal in the colliery?—I believe they do. This water is very hard, and there is a deal of sediment in it.

3886. (*Professor Way.*) You stated that as the water came out from the filter beds it was quite clear?—You could not see the colouring matter, that appeared to be gone.

3887. When the liquid has got into the tanks have you used it for condensing water for the engine?—Yes.

3888. Is it not sufficiently clean to use for washing, or is the tank so situated that you could not use it for that purpose?—It is so situated that we could not use it.

3889. Would the liquor be sufficiently pure for washing purposes if the tank were otherwise conveniently situated?—I do not think it would be, because the ochrey water which it contains is so very bad.

3890. If everybody could purify the water as you do, and then for a certain number of hours in the day discharge it into the river, would it be fit to be used for washing purposes?—I should almost think not.

3891. (*Mr. Harrison.*) Have you had an opportunity of judging of the purifying power of the earth after the water has passed over it? Do you ever see the water come out again?—No, it sinks in, so that we do not perceive it.

3892. (*Professor Way.*) And weeps out, I suppose, along the edge of the bank?—Yes, it gets into the stream low down.

3893. (*Mr. Harrison.*) Can you see it there?—Sometimes we can.

3894. Is it then purified?—Yes.

3895. This process prevents your extracting the oil and grease out of the refuse?—Yes.

3896. You would not like to put it on if those had been extracted out of it?—No. I think that if we were to put dye refuse on alone it would injure the crop.

3897. This process prevents your getting something by extracting the oil and grease?—Yes. We had 20*l.* a year offered us by parties who undertook to extract the oil and grease; this sum we now lose in consequence of putting the whole liquid on to the land. We were afraid that by their chemical process further litigation would be caused, and therefore we did not accept the offer.

3898. (*Professor Way.*) Supposing that the grease was extracted and that you were then to deliver on to the land the dye water, and the water coming from their grease extracting process, would that be injurious to the land?—That would depend upon the process by which they get the grease out.

3899. It would not be the absence of the grease that would make the liquid injurious?—No; it would be the chemical process to which the greasy water had been subjected.

3900. Do you know what it is?—No.

3901. You are perhaps not aware that there is an acid used in it?—Yes, I am.

3902. You would not like to pump water containing acid on to the land?—I believe it would do it harm.

3903. Do you believe that the water from the washing of the wool would sufficiently counteract the water from the pans without the water from your washing machines, I mean without the water with the oil in it?—Yes; if you had a tank large enough to contain them all, and could so mix them together, but you must have all the water in a tank before you let your dye pans out at night.

The witness withdrew.

Mr. R. Holliday.

Mr. Read Holliday (Huddersfield) examined.

3904. (*Mr. Harrison.*) Are you a resident in Huddersfield?—Yes.

3905. Have you been for many years resident here?—Yes.

3906. Have you had opportunities of observing the river and its condition compared with what it was when you first knew it?—Yes.

3907. Has it become very polluted within your recollection?—Yes, it has.

3908. What business do you carry on?—I am a manufacturing chemist.

3909. In Huddersfield?—Yes.

3910. (*Professor Way.*) What substances do you manufacture?—I manufacture analine and products from gas-coal tar.

3911. What else?—All the articles that are required for making analine colours, such as arsenic acid, nitrobenzole, and phenic acid.

3912. All those substances are made from expensive materials are they not?—Yes.

3913. Such materials as you do not choose to waste if you can help it?—Yes.

3914. Do you produce any refuse matter?—I do not know that we do.

3915. Not in the production of the analine dyes?—We have refuse from the colour works which I should call arsenious acid.

3916. Does that go out in solution?—No, it is in an insoluble state; it is a precipitate.

3917. Do you oxidize it again into arsenic acid?—Not as a matter of course; it may be worth our while to do it. Some acid makers do it.

3918. That is to be done, and sombody perhaps does it for you?—No, we oxidize it ourselves; we oxidize the arsenious acid, but we get the refuse again; we extract it after the colour is made. There is a certain quantity of residue which consists chiefly of arsenious acid.

3919. You do not use that again?—No, because it is so dirty.

3920. Is is your practice to send it away?—No, we keep heaping it up; we expect to have to use it.

3921. Is it in such a bulk as to be an inconvenience to you?—No.

3922. You do not throw it in the river?—No, we have no need to do that; we think we shall be able to economize it at some future time.

3923. Is there any liquid which runs during that process at all, or does all the liquid go into the dye?—No, the liquid left after crystalization is taken and the remaining colour precipitated with alkali; the liquid runs into the river after precipitation.

3924. Is that a large volume?—Perhaps 500 gallons a day.

3925. Is it coloured a little?—Yes.

3926. Have any complaints been made about it?—No.

3927. Would it contain any arsenic?—I should think it would contain a little.

3928. You think you have extracted all that is of value to you from that liquid?—Yes.

3929. Could you run 500 gallons a day into the common sewer?—No, we have not one. We use a private sewer jointly with a large dyeworks near us.

3930. Do you make alum or anything of that kind?—No.

3931. Do you make salts of tin?—No.

3932. Nor for mordants?—No.

3933. Is there anything else you make?—We have not quite given up distillation of gas tar. We have products of tar, oil, and pitch, and so forth, that we use for asphalting and burning. We sell the oils and we sell the pitch.

3934. What becomes of the water?—The water is used by Mr. Marriott to make liquid ammonia from.

3935. You do not throw anything into the river from that source?—Nothing whatever.

3936. Do you make anything else?—Nothing.

3937. So far as your works are concerned the injury done to the river is limited?—Yes; there is a large manufactory that is used for woollen goods that I find power for, and we use the river water for condensing purposes.

3938. As any other manufacturer would do?—Yes.

3939. But that is in no way connected with your chemical works?—No; we have a lamp factory, but there is no refuse from that.

3940. Is there anything likely to be washed from the arsenious acid into the river, or is it kept under cover?—Yes, and in time we shall convert it.

3941. What quantity of that have you?—Perhaps we have got 20 tons on hand.

3942. How many years has that been accumulating?—Three years.

3943. Is it kept in barrels?—No, we have it heaped up.

3944. Under a shed?—No, a part of it is, and part is not.

3945. Supposing that heavy storms of rain fell and washed out the premises on the river side?—But that refuse is 500 yards from the river at least.

3946. And no drainage leads from it?—No, it is in a field.

3947. Does it destroy the grass in its neighbourhood?—Just on the edge of the heap it does.

3948. Is arsenious acid very soluble in water?—Not at all; if it is it is very imperceptible.

3949. (*Mr. Harrison.*) Is there any point to which you wish to draw the attention of the Commissioners?—I have been asked by some gentlemen, before I came here, to inquire whether our river waters at various points have been taken and analysed.

3950. (*Professor Way.*) Do you think it is desirable that that should be done?—I think it is very important, because the last witness examined stated that where he was situated, ochrey water from coal pits destroyed the river water for any use for dyeing, and that the water was injurious for boiler purposes. We find down at our place that the water is very black and dirty, but it is good for boiler purposes and for condensing purposes, also it is better for those purposes down here than where he is. There is a large quantity of ochrey water in this country, and I have known it come and spoil the whole of the canal and stop the dyeworks.

3951. (*Mr. Harrison.*) Have you supplied power for the manufactories you have mentioned for some years?—For two years. I have always had steam boilers and engines.

3952. Have you found the effect of the water upon the boilers to vary in your experience?—Yes.

3953. Do you find that the water improves or not for boiler purposes?—As to the river water, I have not found that improve very much for boiler purposes; the land water I find very bad indeed. After you have made a well and sunk for water which is very much wanted the water is worthless for any purpose.

3954. You think that the water from the land is affected by any operations in the neighbourhood?—I do not.

3955. Is it the same as it was 20 or 50 years ago?—Yes.

3956. Is the river water the same as it was?—Yes as far as condensing purposes go, but for dyeing or any fine purposes, or chemical works, we cannot use it at all.

3957. (*Professor Way.*) I suppose you know that there are two kinds of hard water, water containing carbonate of lime which is softened by boiling, and water containing other salts of lime which is not softened by boiling?—I suppose so.

3958. I suppose the first water is the one which first furs the boilers, I mean the water containing carbonate of lime?—Yes.

3959. Do not the dyeworks in this district discharge a quantity of acids into the water?—I should question very much whether there were not more alkalis thrown into the water than acids; but acids also are thrown in.

3960. Under those circumstances any carbonate of lime would vanish from the water?—Yes, and be decomposed.

3961. Whereas the probability is that the water you draw from the wells and springs of the district is very hard from carbonate of lime, and I suppose that water would not be fit for boiler purposes?—Never, so long as you go only to a certain depth, say 10 or 20 yards deep, but if you go below that you can get very good water, at other places you cannot get good water under 100 yards from the surface.

3962. You get the water of the main district?—Yes.

3963. (*Mr. Harrison.*) Is it your experience that the river water causes as much incrustation on the boilers now as there was at any time within your recollection?—Yes. I am desirous also of asking whether the sludge, the precipitate in the bed of the river, has been analysed, and what gases it contains. I take it that the water itself does no injury to health generally, but that it is the gases evolved that are injurious. I think it would be useful if we had an analysis of the precipitates, and ascertained what gas is given out during hot weather by our river. In our neighbourhood we have some dam stakes, and those dam stakes have impeded the sludge a good deal, and for perhaps 500 yards, in the summer time, the bed is

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exposed to the sun; I should like to know what that sludge is, and what gases it gives out.

3964. Will you tell us whether you think the matters which enter the river in the water which has been used for dyeing and other purposes can be readily separated, and at a reasonable cost by chemical or mechanical process?—By mechanial processes I think they might be, with due care in the use of the water to keep the dyewater and the sud water separate from all others, and to make the water to be dealt with into as small a volume as possible; perhaps then they might be able to separate the matters.

3965. You do not think that it is impossible to do it?—I do not think it is; perhaps it might be very costly, and it would be very necessary to increase the supply of water. If we were to take the river water as it is now and the canal water, and use it for manufacturing purposes, and then instead of passing it back fouled into the river or canal, send it into drains, we should have no river here at all; it would all have gone down the drains.

3966. Supposing every manufacturer was to take these waters and use them, and then purify them as far as he could, and restore them to the river, there would be no great diminution in the river water then?—Yes, there would be a good deal of evaporation during his manipulations.

3967. That occurs now does it not?—Yes; you would have to spread the liquid, as the former witness said he did, into tanks. I do not think there would be the same supply; what I want very much is a large supply of water.

3968. Have you observed the sludge of which you have spoken?—Yes.

3969. Does it become a nuisance when it is so exposed?—Yes it does.

3970. Is it injurious to health at all?—I should say so; there is a good deal of nuisance in it.

3971. It is a nuisance and therefore you think it ought not to be allowed to remain in the bed of the river?—Yes.

3972. Any steps that might be taken to prevent its being put into the river would be a benefit to those residing on the banks of the river?—Precisely so.

3973. (*Professor Way.*) I believe that aniline dyes are used for scarlet and for delicate colours?—Yes.

3974. Do you find the demand for aniline dyes increasing very largely in this district?—Yes, I think it is on the increase.

3975. Do you think that the dyeing of these aniline colours requires pure water, or can you do it with moderately pure water?—With water moderately pure.

3976. Is the river water of this district good enough?—No.

3977. The gas products from which you derive aniline are principally the gas tar?—Only that.

3978. Do you obtain it from the large works in the town or from private works as well; manufactures who light their mills with gas?—When I was engaged extensively in the trade of distilling tar, I got it from all sources; the fact is I have taken it from seven or eight different towns between this and Lancashire, but I have now given up the business a good deal and get tar only from Sheffield, I obtain it from the gasworks there; I buy crude naphtha; I begin with that. I extract naphtha for burning, and naphtha for dissolving indiarubber, and so forth, and also benzole for making nitro-benzole.

3979. Then I suppose you have two separate factories?—Yes.

3980. The only product that you bring from the naphtha factory is the benzole, I suppose?—No, that is in the naphtha.

3981. Can you tell us whether it is worth a manufacturer's while when he makes gas on his own premises to light his own mill, to keep the tar?—Decidedly it is very valuable to keep and sell.

3982. Do they ever throw it into the river?—I think not.

3983. Nor any of the other products?—I believe that very deleterious products from gasworks are put into the river.

3984. More from small works than from large ones?—I do not know that. The Commissioners may remember that there was a case in London in which the gas company had this stuff pumped into barges, and taken and emptied into the middle of the river Thames; it is that kind of stuff that goes into the river here.

3985. You do not believe that much of the tar is wasted in this district?—No.

3986. They preserve it at all the works, and somebody goes round to collect it?—Yes, and also the ammoniacal liquor is generally so disposed of.

3987. What you speak of as being sent into the river is the lime refuse principally is it not?—Yes, and the liquid from the bottom of the purifier, and that which condenses in the street pipes; it is not made available for any purpose that I know of.

3988. Does not that contain ammonia?—Not of any use. In emptying the purifying boxes of course there are many gases.

3989. There is the tar, the ammoniacal liquor, and the spent lime, those are the three principal products?—Yes.

3990. We have been informed that none of those have been thrown into the river?—No, not in quantity.

3991. What is the fourth form of waste that you say does get into the river?—That which condenses from purifying boxes, and from gas-pipes in the streets.

3992. How does the water from the latter get into the river?—It is pumped out I suppose; there will not be much in the pipes in the streets at this end of the town, but in the pipes at the bottom of the town I think there is some.

3993. It is not in any larger quantity?—No, but what there is of it is very bad. At many of the smaller gasworks on the banks of our river refuse tar and gas-lime along with ashes are put in; the effect is seen at a considerable distance from the place.

The witness withdrew.

Mr. E. Brooke, jun.

Mr. Edward Brooke, jun., examined.

3994. (*Mr. Harrison.*) You reside in this neighbourhood?—Yes, I reside at Edgerton and I wish to speak more in reference to the place where my father lives, and I wish to represent him.

3995. How far is that from Huddersfield?—A mile and a half on the low side of the town, on the Calder.

3996. Has your father any property adjoining the river?—Yes.

3997. For what distance does it extend?—Perhaps a quarter of a mile. There is both a river and a beck which run through my father's property; the beck is a sluice properly so called to conduct the water to the water-wheel.

3998. It is the Colne and a byewater?—Yes; the river goes at the bottom of the land, and the byewater, which is about half-a-mile long, passes close to the house, and within about 60 or 70 yards of the house there is a weir, and owing to the present impure state of the water it is extremely unhealthy to live down at the house.

3999. Has your father, or his family, suffered from ill health in consequence of the condition of the river?—Yes, for a considerable number of years. The gases which are given out during the time the mills are at work affect the health of the family very much, and particularly my sisters, they suffer from nausea a good deal and are obliged to leave home for a considerable part of the year.

4000. Has this been an increasing annoyance?—Yes, it gets worse every year.

4001. Has your father taken any steps to have the nuisance removed?—No; I do not suppose he can, it is quite impossible for him to do anything.

4002. He is powerless?—Yes; during the greater part of the day the waters are in the goit, and then the bed of the river is dry, and in the summer months the smell given off from the bed of the river is very bad, and the nausea caused is very considerable indeed. When my sisters go away from home they are quite well and in the enjoyment of good health, but when they come back, after a few days, they suffer again, and when they have been at home a short time they are obliged to go away somewhere else.

4003. Do you attribute that ill health to the condition of the river?—Yes, and to the bad gases that are given off. The evil happens more particularly during the summer months, and just now in the autumn months.

4004. (*Professor Way.*) Does the medical man who attends your family attribute their ill health to the same cause?—Yes, to a great extent.

4005. (*Mr. Harrison.*) Do you experience nuisance from any other source besides the river?—I do not know that there is anything else.

4006. Do you find the smoke in the neighbourhood a nuisance?—Not much.

4007. Is your father, or are you, engaged in any manufacture?—Yes, we are engaged in the manufacture of sanitary tubes.

4008. At the large works we have seen?—Yes.

4009. Is there much smoke thrown out from those works?—No.

4010. They are on the road to Dewsbury?—Yes; on the railway to Dewsbury.

4011. In the manufacture of those sanitary tubes is not a considerable amount of gases sent out?—No coal smoke.

4012. Have you taken steps to remove the gases and smoke to a considerable height?—Yes, we spent a large sum of money in erecting a chimney, and putting all the flues into one stack.

4013. Did you do that in consequence of complaints made by people in the neighbourhood?—Yes.

4014. Has the health of the neighbourhood improved since you built that chimney?—Yes, but the health of the neighbourhood did not suffer before from the smoke from our works, it was supposition on their part.

4015. (*Professor Way.*) Any smoke you would make would be from the ovens?—Yes.

4016. Is it difficult to heat kilns without producing smoke?—No; when the kiln gets to a pretty good heat the smoke is generally consumes when the kiln is once well fired.

4017. (*Chairman.*) How many years have you made tubes at your works?—About 20 years.

4018. What clay do you use?—Fireclay.

4019. Do you obtain it from coal workings?—Yes.

4020. Of what dimensions do you make the largest sanitary tubes?—We have made them 4 feet in diameter.

4021. With sockets?—Yes.

4022. Where were they used?—At Scarborough.

4023. How much per foot run do you charge for a 4-feet pipe?—I think they were three guineas a yard; but it does not pay to make them.

4024. What is the smallest size pipe that you make?—Two inches in diameter.

4025. What are they used for?—For conducting water in Wales down mountains.

4026. Not for draining purposes?—No.

4027. Do you make soil pans?—No.

4028. Do you make arrangements for purifying sewers?—Yes.

4029. Under a patent?—Yes.

4030. Have you any of the diagrams here?—No; but I will send them up, if you please.

4031. How long have you made them?—About four months.

4032. Have you sold many of them?—We have sold a great many in the south, and in Lancashire too.

4033. Do you use charcoal in them?—Yes, wood charcoal.

4034. Have you supplied any to the Dewsbury Commissioners?—No.

4035. What royalty do you charge to any person for making use of your ventilators?—We make them ourselves and supply them complete.

4036. You have registered them?—Yes, we have patented them, gullies, traps, and ventilating arrangements.

4037. Where do you find the greatest demand for them?—In London, Yorkshire, and south Lancashire, also in the United States.

4038. Do you make circular or egg-shaped tubes?—Both.

4039. Where do you send the egg-shaped tubes?—All into Lancashire.

4040. Have you any standard of thickness in proportion to the diameter?—It is 1 inch in thickness for a diameter of 12 inches.

4041. And for a diameter of 2 feet what would the thickness be?—An inch and three quarters; and for a diameter of 30 inches a thickness of 2 inches; and for a diameter of 3 feet, a thickness of $2\frac{1}{2}$ inches.

4042. Finished or in the mould?—$2\frac{1}{2}$ inches burnt.

4043. What size must you mould the clay to produce that thickness?—The clay does not shrink in the thickness, nor does it shrink in the diameter, at least not more than three quarters of an inch to a foot.

4044. It does not shrink in substance?—No.

4045. Do you arrange your coals so as to burn all the smoke?—Yes; the smoke of one kiln passes through the flue of another, and the smoke is thus, to a great extent, consumed.

4046. Have you ever seen Mr. Doulton's kilns at Lambeth?—Yes.

4047. Are yours made on the same principle?—No, it is not that particular arrangement.

4048. Have you an arrangement to prevent smoke to the same extent?—Yes, to a very considerable extent.

4049. (*Professor Way.*) That is to say, the smoke from another kiln lighted goes into a kiln which is already red hot?—No, it goes into the flue of the kiln in a state of great heat, and so is burnt.

4050. (*Chairman.*) Smoke from a kiln newly lighted passes into a kiln at a very great heat?—Yes.

4051. Do you use salt in glazing?—Yes.

4052. At what period of the burning do you throw in the salt?—In the finishing process.

4053. Do you produce any injurious fumes?—No.

4054. The glazing causes no nuisance?—No.

4055. What do you do with your solid refuse?—Do you mean the ashes?

4056. Yes, or any broken material?—We have just had a considerable windfall, we had about 20,000 tons of ashes in stock, and we have sold them to the railway company; they have just cleared us out, or else we had a large accumulation.

4057. Are you on the margin of the river or the canal?—On the canal.

4058. Did any of your ashes or refuse go into the canal?—No.

4059. In your case you had to make a cinder heap at great inconvenience to your business?—Yes.

4060. You had to provide land for the purpose?—Yes.

4061. Supposing the railway company had not agreed to take away the 20,000 tons, what must you have done?—We must have ground the ashes up with clay and made bricks of them.

4062. You have been saved the cost?—Yes.

4063. If you do not get such a windfall in future the accumulation will go on?—Yes, unless another railway will take them up.

4064. Have the ashes been tried for brick-making in this district?—No, I do not think they have been, but a very good brick might be made out of a con-

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siderable proportion of ashes ground fine and mixed with clay.

4065. That would be like the London process?—Yes, but a larger proportion of ashes might be used; they do not allow bricks to be used here, and a very inferior brick would do for inside work.

4066. If you could make good bricks with your ashes, I suppose other people might do the same?—I do not know whether it would pay them to do so, but I think that it would do so more in the neighbourhood of Sheffield where I have had a demand for ashes for grinding with mortar.

4067. Have you had occasion to use ashes recently?—Yes, we always use a considerable portion of ashes when we make mortar, as much as we can.

4068. You grind them up with your lime?—Yes.

4069. Have you a larger demand for your pipes than you had formerly?—Yes, a great deal.

4070. Did you send many into Lancashire during the cotton distress?—Yes; our principal trade was with Lancashire during the cotton distress.

4071. To towns which were carrying out their sewerage works?—Yes.

The witness withdrew.

Capt. Graham.

Captain Graham (Huddersfield) examined.

4072. (*Chairman.*) You hold some appointment under Sir John Ramsden?—I am the land agent of Sir John Ramsden here.

4073. How long have you held that appointment?—About two years.

4074. Was that your first acquaintance with this district?—Yes, with this immediate neighbourhood.

4075. In what condition do you find the streams and rivers of this district as regards purity?—They are all extremely polluted.

4076. Have you had to negotiate any sales of land recently for mill or building purposes?—Only leases of land.

4077. For mill purposes?—Yes.

4078. In your opinion will the condition of the rivers have any influence upon the sale of that land?—Yes, very great upon its value.

4079. Have you had any objections raised to the condition of the rivers by would-be purchasers?—I have not, but they simply avoid those portions of land which are near to the river as being useless to them for mill purposes, they all go away to the canal side in order to get clean water.

4080. They go where there is clean water?—Yes.

4081. Then I suppose that you have come to the conclusion that if the river were in a purer state the river sites would have more value than they have at present?—No doubt, very much so.

4082. Have you as land agent had occasion to complain of special pollutions at any particular points?—I have.

4083. Have you had occasion to either threaten or take proceedings at law?—No, I have not had occasion to do either the one or the other; but last year I found that about 40 persons were casting ashes into the river Holme within a distance of about two miles, and I wrote to each of those persons requiring them to discontinue the practice.

4084. Did they do so?—I cannot say exactly whether all of them had done so, or whether any of them had neglected to do so. I expect that the greater part of them have discontinued the practice.

4085. Do you know the condition of the river Holme as it runs through Lockwood?—Yes. At that time I found that there were three persons within a distance of about 200 yards, who had been casting ashes and soil excavations into the river so as to go over almost two-thirds of the channel just below Lockwood Bridge.

4086. Had you any authority over that part of the stream?—Yes, and I wrote to those persons accordingly.

4087. Do you think that they discontinued that practice?—Yes, I think that they have done so.

4088. Have you any hope of being able by the existing power to prevent that abuse?—Not entirely. I have power as the agent of the landowner, but I should have to exercise constant vigilance and supervision which would be almost too much for me. I should have to spend a good part of my time in doing it.

4089. Do you think that it would tend to your comfort or otherwise if you had to be prosecuting offenders in that way?—I think that you need hardly ask that question.

4090. You would not like to be in so invidious a position?—Certainly not.

4091. And I assume that you think that it is a situation in which you ought not to be placed?—I feel so very strongly.

4092. You think that the law ought to provide some means of preventing the nuisance?—Certainly.

4093. I suppose that you would not like to be made informer general for the river any more than you would like to be made an informer of the police force?—Naturally not.

4094. In your communications with mill owners have they ever complained to you of the foul state of the water?—I do not think that the mill owners themselves have.

4095. They would perhaps consider that you had no power to remedy it, and they take the river as they find it?—They take it as they find it.

4096. But in your belief, the foul state of the river injuriously affects the value of the land?—There is no question of that.

4097. Have you had any complaints of the river being noxious or giving off unwholesome exhalations?—No complaint of that has been made to me, but I am satisfied that it is so.

4098. Has Sir John Ramsden much agricultural land outside the town over which the rivers and streams flow?—Yes, I should say between 3,000 and 4,000 acres.

4099. If any person wished to purchase that land as residential property, to lay it out in an ornamental manner, I suppose that the state of the water would be an objection?—I should say that it would altogether prevent the sale for that purpose.

4100. Have any of your farmers complained to you that the cattle could not use the water?—No, they have not.

4101. I suppose that that is a matter which has grown up and that they have been obliged to provide some other means for watering their cattle?—I think that they actually water them now from the river.

4102. In some instances?—Yes, in a great number of instances.

4103. Have you had any cattle plague in this district?—Yes; but only slight.

4104. You could not say that the foul state of the water had caused the cattle plague?—No; I should say that it had not.

4105. Do you think that Sir John would object to a properly constituted authority being established to prevent river pollution?—No; I am satisfied that he would be very glad to see such an authority constituted.

4106. He would be very glad to second it?—Yes, I am sure that he would.

4107. (*Mr. Harrison.*) There are two mills near the junction of the narrow canal with the broad one, which belong to Sir John Ramsden?—Yes.

4108. The first length of the canal is used as a kind of pound for the supply of the power to those two mills?—Yes.

4109. And water from the river is turned into the canal for that purpose?—It is so.

4110. And in consequence the broad canal is polluted throughout its whole length?—Yes.

4111. Has Sir John Ramsden property upon the banks of that broad canal?—Yes.

4112. You have stated that the value of the property would be very much increased if the river were free from pollution?—Yes.

4113. Is the value of the water power of those two mills so great that it is worth while to pollute the whole four miles of canal for the purpose of maintaining that power?—No, I should say that it was not.

4114. Do you know that the wide canal might be supplied with perfectly pure water from the narrow canal?—Yes, I know that.

4115. Does not it seem a very desirable thing that the pollution of those four miles of canal should be prevented if it can be done so easily?—If we cannot get the river cleaned, so as to have clean water turned from it into the canal, it may be wisdom to keep the river water out of the canal altogether.

4116. We have had it in evidence that the canal is a greater nuisance through a part of the town than the river itself?—No doubt, because it is comparatively stagnant.

4117. Under all those circumstances do you not think it very desirable that Sir John Ramsden should take some steps to alter that condition of things?—I have not considered that question and therefore do not like to return an off-hand answer to it.

4118. Does a great part of the town of Huddersfield belong to Sir John Ramsden?—Yes.

4119. We have from the registrar a return of the death rate, for sometime past in the township of Huddersfield; the township is divided into five divisions—Huddersfield, Marsh, Fartown, Deighton, and Bradley?—Yes.

4120. Do those divisions belong to Sir John Ramsden?—All except Bradley.

4121. The death rate in the division of Bradley appears to be about 12 in the 1,000?—Yes.

4122. That is a very low death rate?—Yes.

4123. But the death rate of the adjoining division, namely, Deighton, is 56 in the 1,000?—Yes, it is very bad indeed; I am quite aware of that.

4124. Can you give any reason for that immense death rate in the division of Deighton?—Yes; in the first place, they have very insufficient arrangements for sewerage, then they have unwholesome dwellings, and thirdly, they have very bad accommodation in the way of privies and ashpits. I believe the high death rate is entirely owing to those three causes.

4125. Is the property Sir John Ramsden's?—A portion of it; there is a local board government now, and half the houses are the property of the lessees; the whole of them are not Sir John Ramsden's.

4126. As agent for Sir John Ramsden do you think that it is your duty to look to the condition of those cottages?—Clearly, and I have been doing so.

4127. A death rate of 56 in the 1,000 is a fearful death rate?—It is enormous.

4128. And any steps which could be taken ought to be taken, and that immediately, to improve that condition of things?—No doubt.

4129. There is another division, viz. Marsh, which also appears to have a very high death rate?—Yes.

4130. Does the property there belong to Sir John Ramsden?—Some part of it, but not the whole.

4131. Is it also capable of improvement?—Yes, I should say so decidedly.

4132. Are you taking steps to improve it?—I cannot say that I am, they have a local government there.

4133. Are Deighton and Marsh near the river?—Marsh is not, Deighton is.

4134. Do you think that the health of the inhabitants is at all affected by the condition of the river?—Not in the least.

4135. But merely by the condition of the houses?—Yes.

4136. Sir John Ramsden, you say, has a considerable extent of land beyond the boundaries of the borough?—Yes.

4137. Is there any land suitable for sewage irrigation?—No, I should say none.

4138. Not even if the sewage was pumped to a height?—It might be done physically, but you would have to do it over land which is prospective building land.

4139. (*Professor Way.*) The land would be too valuable for that purpose?—Far too valuable.

4140. And it would become more so if the river were purified in the next few years?—Yes, very much more valuable.

4141. (*Chairman.*) In the instances where that high death rate is, do the cottages belong to Sir John Ramsden as well as the land?—Yes, now they do; he purchased the property a few years ago, I may say 10 years ago; some settlement was made at that time by which he purchased the whole, but, before he purchased, all who desired to have leases had them granted to them.

4142. (*Professor Way.*) You spoke of cattle drinking the water of the river up to the present time, were you then speaking of the Calder?—No.

4143. Of what river were you speaking?—Of the Colne.

4144. Is the Colne as full of foul matter as some other of the streams?—I do not know whether it is so bad as the Calder.

4145. We have been told that in some cases cattle will not drink the water?—I should not think that it is quite so bad as the Calder, but I do not know.

4146. Of course it is a serious inconvenience to the farmer if his natural water supply is such that he cannot avail himself of it?—It is so, no doubt.

The witness withdrew.

Mr. Wright Mellor, President of the Chamber of Commerce, Huddersfield, examined.

Mr. W. Mellor.

4147. (*Chairman.*) Are you engaged in manufacture?—I am.

4148. Are you a cloth manufacturer?—Yes.

4149. Where are your works situated?—At Milnes Bridge.

4150. How far is that from Huddersfield?—About 2½ miles.

4151. Are they situated upon the river?—Upon the river Colne.

4152. Above or below the town?—Above the town.

4153. About what number of hands do you employ?—At the works about 170 or 180.

4154. Do you carry on dyeing?—Yes.

4155. And washing?—Yes.

4156. Cloths?—Both cloths and wool.

4157. Where do you obtain your water for washing and dyeing purposes?—From the river.

4158. Have you any other supply than the river?—None.

4159. How long have the works been established there?—From three to four years.

4160. Then I assume that you found the river polluted when you went there?—We did, but not so much as it is down here.

4161. Has it become more polluted since your works have been established there?—I do not think that it has, I think that it is about the same.

4162. What power do you use?—35-horse steam power.

4163. You use no water power?—No water power.

4164. What do you do with your ashes?—Hitherto we have had to fill up a good deal of the uneven ground about the factory, and likewise to make a road, and we have appropriated most of the ashes for that purpose.

4165. Have any of them gone into the stream?—We have not sent in 100 cartloads since we commenced the works.

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4166. But there has been no restriction upon your doing so, and if you had thought proper you might have sent them in?—We suppose so.

4167. Do any persons above you send in ashes?—I believe that they do, I cannot speak to that with certainty.

4168. And below you as well I suppose?—Yes.

4169. Where does the night-soil from your mill hands go?—Into the river.

4170. From the privies?—Yes.

4171. Are they built so as to project over the river?—No, they are built as waterclosets, and the refuse is conveyed into the dye water.

4172. And it becomes mixed with the dye water before it reaches the river?—Yes.

4173. Have you had any complaints made against that mode of passing refuse into the river?—None.

4174. You, I suppose, are only doing what is common above and below you?—That is all.

4175. How long have you had a chamber of commerce in Huddersfield?—About 15 years I think, from 15 to 20 years.

4176. I assume that you are in communication with other chambers of commerce throughout the Kingdom?—We are.

4177. Have you the means of stating in weight the amount of wool which comes into Yorkshire and the amount of cloth which is sent out?—That I could not say; I saw the evidence which Mr. Eastwood gave yesterday on that subject, and on thinking it over this morning I thought that it was a pretty fair estimate.

4178. If we wanted that information where would be the best place to apply for it?—You might get the quantity of wool I apprehend from the carriers in the district. That would be one source to apply to.

4179. Do the board of trade take any cognizance of it for Government purposes?—I am not aware that they do.

4180. Does wool pay a duty?—No, it did formerly but it does not now.

4181. And there is no Government authority whose duty it is to ascertain the gross imports and exports?—You could get the gross imports of wools into the whole of the kingdom, but I do not know that there is any special means by which you can find out the proportion coming into Yorkshire.

4182. What weight of wool do you deal with in your manufactory?—From 250,000 lbs. to 350,000 lbs. weight per annum.

4183. Pure wool?—Yes.

4184. From what part is it usually brought?—It is Australian wool.

4185. Is it always washed?—No, some of it is not washed at all, there is a great variety in that respect; there is wool in the grease unwashed, then there is wool partially washed, and there is what is termed scoured wool.

4186. You mean wool which comes to you scoured?—Yes.

4187. Do you treat any of your wools by steeping them before they go into the manufacturing processes?—Yes, we scour the unscoured wool.

4188. Have you heard of the method of getting carbonate of potash from raw wools by steeping them in water?—No.

4189. You have not heard that it is being carried out in France?—We have not heard of it, and consequently we have not endeavoured to apply it at all.

4190. As to the refuse water from the wool washing, and from the dyeworks are these (*pointing to the bottles*) fair samples?—The one representing the black liquid from the dye, and the one representing the material from scoured wool are fair samples.

4191. Do you utilize any refuse matter from your operations?—Yes, we have for two years past utilized [illegible] and oil in the washings from the pieces.

[illegible] ould [illegible] [illegible]at has been done by yourself or by some [illegible]ng it. [illegible]ms it?—We went to the expense ourselves of p[illegible]ou [illegible]n the works at the commencement.

4089. [illegible]to [illegible] carload [illegible]wise it [illegible]

4193. But it has been carried on for two years?—It has.

4194. And with a certain amount of profit to yourselves?—Certainly, or else we should not do it.

4195. Did you hear the evidence of Mr. Brooke this morning?—I did.

4196. Do you agree generally in that evidence?—In a great portion of it.

4197. Have you any spare land near to your premises?—No, we have none excepting a very small quantity of building land; we have no opportunity at all to purify the water by irrigation.

4198. So that if a filtration process is to be carried out it must be something very compact to do you any good?—It must.

4199. Do you think that you have not space for ordinary filtration?—Yes, we have space for it at present, provided that there was a process known and one which we could apply.

4200. That is to say, provided that there was some economical and efficient process known?—Quite so.

4201. I suppose that you are in communication with a large circle of Yorkshire gentlemen connected with the woollen trade?—Yes, I know a great many of them.

4202. What is the general feeling, so far as you have gathered it, with regard to the present condition of the rivers and streams of Yorkshire?—It is by no means satisfactory, but I fancy that we have all been alarmed by the difficulty of purifying the stream and remedying the evil.

4203. I suppose that the trade of the district has increased very greatly?—Very considerably indeed.

4204. Do you think that it has increased in a larger ratio in the last 10 years than formerly?—I should say so; in the last 10 or 15 years decidedly.

4205. Is it increasing now?—Yes.

4206. Did the cotton famine give an impetus to the woollen trade?—That is generally supposed to have been the case, and I should say that to some extent it was.

4207. Has the woollen trade at all gone back since the resumption of the cotton trade?—I should not say that it has; there has been no change beyond the ordinary and periodical fluctuations which are found in all species of trade.

4208. Do you think that you have reached the ultimatum of the woollen trade?—That is a very difficult question to answer. I should not at all say that we have got to the full extent of our progress. I should be very sorry to say that, and I do not know that there are any facts to warrant such an inference provided that the relations existing between masters and workpeople are of such a satisfactory nature as will enable us to still go on as we have done.

4209. Have there been more difficulties recently with the workmen than formerly?—Not specially in this district; I am not aware of any difficulty.

4210. I suppose that we may assume that if the trade of the district increases, without some remedy being provided, the pollution of the streams will increase also?—Judging from appearances it is likely to do so.

4211. Do you know any of the streams to be so foul that the water is almost entirely unfitted for manufacturing purposes?—Speaking for our own establishment, we use the river water for the whole of the purposes to which we require to apply it, both dyeing and washing, and therefore, so far as we are concerned, we have not yet suffered any inconvenience.

4212. Having started four years ago I suppose you chose a kind of manufacture which you knew that you could carry on with that water?—We are in this condition, we have the canal on one side and the river on the other, so that if the river water did not suit we could have recourse to the canal. We applied to the canal company and we got a pipe put into the canal so that we might avail ourselves of it in case of need, hitherto we have not required to do so.

4213. What class of goods form the staple of the

manufacture of this district?—There is a great variety.

4214. Are they heavy goods or light goods?—They are heavy trowserings principally, and likewise broad cloths, we have two or three very large establishments for the manufacture of broad cloths, the same as the Leeds manufacture, and we have an immense number of manufactories established for the manufacture of fancy trowserings, that is an increasing trade now.

4215. Do you know whether any of the fancy trade has deserted Yorkshire for Scotland in consequence of purer water existing there?—I cannot say that it has for that reason; there is no doubt that the Scotch tweed trade has progressed very rapidly indeed during the last few years, and for the manufacture of that class of goods pure water is almost indispensable; you cannot get out the colour and the general appearance of the cloth unless you have pure water to wash in.

4216. Could you manufacture such goods at your works with your present water?—I would not say that we could, I think it is probable that we could not.

4217. Then if the Scotch from their mountain streams have a larger volume of pure water they are enabled to take that business from Yorkshire?—In so far as the water has to do with the manufacture they must necessarily do so.

4218. Do you think that they have other advantages?—I do not know that they have; we go to the same markets for our wools, and we think that our workpeople are as skilful and industrious as theirs, and we have sufficient capital in the district to enable us to do our work, so that I cannot think that they have much advantage over us; there may be something in the public taste, the public taste perhaps may run upon their class of goods.

4219. If the Scotch people extend their manufactures and neglect their rivers they may run a neck and neck race with you?—They cannot neglect their rivers and preserve their position.

4220. If they wish to preserve the advantages which they already possess they must do something to keep their rivers pure?—I should say so, unless they have independent sources of supply.

4221. Have you at all thought what kind of jurisdiction would be appropriate for preventing this pollution. What kind of board should be established?—I should say that any jurisdiction which you might have ought to be in the main originated in the district itself.

4222. That there should be representatives of the different trades concerned?—Most assuredly.

4223. Would you have any superintending power or any power of appeal, or any power which should be capable of making the local body act?—Personally, I am very jealous of a superintending power of that kind. At the same time there is this difficulty, that unless there is a vigilant superintending power, the duty may sometimes be neglected A superintending power may be beneficial, but I should be very sorry to have a superintending power which could exercise any coercive authority.

4224. Do you know what is the duty of an inspector of mines?—To some extent I do.

4225. Do you know an Act known as Lord Derby's Alkali Act?—I know that there is such an Act, but I do not know its provisions.

4226. Do you know that Parliament, with the assent of the manufacturers, has prescribed that the vapours shall not be sent away with more than five per cent. of impurity in them, and that a Government officer is appointed to see that those stipulations are complied with. The manufacturers were consulted upon the Act before it was passed, and I believe that they all assented?—Personally, I should not object to any Act of Parliament being passed for the purification of the river which was passed with the assent of the manufacturers, because I am quite sure that the bill would receive very great consideration before it was passed into an Act; and I think that it would be likely to be an Act operative for good in that event.

4227. Lancashire and Yorkshire through their county and borough members, and the West of England, and in fact the manufacturing districts. are tolerably well represented in our present Parliament, are they not?—Yes, but not too well represented.

4228. But they are represented?—They are to some extent.

4229. Do you not think that if those representatives do their duty to the gentlemen who send them there, namely, the manufacturers, if any bill is laid before Parliament, they will exercise a very powerful influence in modifying that bill?—No doubt the opinion of the district would have very great weight; perhaps more than in former times, inasmuch as the government of the day are much more anxious to ascertain the opinions of Chambers of Commerce in our different towns. They are very solicitous indeed to obtain their opinions on many questions. Gentlemen here, I am sure, can corroborate that statement, and in framing any bill for the prevention of river pollution it very likely that they would consult the wishes of the district.

4230. You are aware that the ordinary course is, that notices are given of a bill, and that clauses may be modified or changed, and you as president of the Chamber of Commerce of Huddersfield would think it your duty to obtain copies of such a bill, and seriously to consider the clauses as they were going through Parliament?—Certainly.

4231. And through your members to make your influence felt in Parliament?—Certainly. Anything which was likely to be disadvantageous to the district we should most strenuously oppose.

4232. But you think that if a common sense bill was drawn, and if the clauses were such as to confer a general benefit upon the whole district, it would receive a fair trial?—I have sufficient confidence in the good sense and judgment of the manufacturers of this district to believe that they would not object to a Bill if fairly drawn, provided the provisions were made co-extensive with the kingdom. Of course I should object to anything like experimental legislation for this district alone.

4233. You are aware, I suppose, that the common law of the land is now powerful enough to reach separate nuisances when put in operation by some resident complainant?—Certainly.

4234. Do you think that it is advisable to trust to that mode of getting rid of a nuisance?—It is a very unpleasant thing for a neighbour to be unneighbourly and ill-natured, and to commence an action against his neighbour. It is done I know, but I do not think that it is always safe to trust to it, in these cases especially.

4235. If new legislation were suggested, and if the answer were made, there is the common law of the land for you; you would not consider that a sufficient answer?—It does not seem so in this case of our rivers.

4236. You think that the legislation should not be such as to set neighbour against neighbour?—Certainly.

4237. But that action should be independent of individual interference, and that the whole locality from the sources of the stream down to the estuary should be under the same form of legislation?—Certainly. It would never do to make fish of one and flesh of another.

4238. With regard to the necessary expenses, which need not be very burdensome, the locality, I suppose, should find by rate or otherwise the means of carrying out the operations of that local body?—Personally I should not have the slightest objection, but should rather hail it as a desirable thing.

4239. In all municipal bodies the state does not aid you, but gives you powers for local self-government?—Yes.

4240. And I am not aware that it interferes with the mode in which you exercise those powers?—It is very indulgent. I may just say that I should have a very strong objection to the system of diverting the course of the river by any exceptional system of

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drainage by which the volume of the river should be diminished.

4241. You would object to a system of intercepting sewers or conduits which would take water from one portion of the stream past mills below?—Yes. Personally I should object to it, because sometimes in a dry time we have very great difficulty in getting a sufficient quantity of water, and in the next place because there would be such an accumulation of objectionable matter in the river that it would become unendurable. Even as it is, when there has been a dry season, and there comes a flood, the water is sometimes almost intolerable, bringing down all the refuse which has, I may say, been festering on the surface of the bed of the river, and I think that that evil would be increased if the water were diverted from the stream.

4242. I suppose that from your knowledge of the district you think that no cut-and-dried plan from any man, however eminent his abilities might be in other respects, would suit all your wants?—Whatever plan any eminent man were to devise would have to undergo a very sharp Yorkshire criticism before passing into a law.

4243. With regard to a conduit for the combined refuse of several mills, we have found that at Dewsbury the owners of seven or eight mills, with the consent of all parties, have one conduit into which they discharge all their waste waters, and that conduit empties itself into the river below the lowest of the mills, and this they do to protect each other?—But I presume that they do not deprive anybody else of the water in the meantime. That is what I should object to.

4244. They do not do that; they turn it into the stream at a mill-head where a gentleman said that he would not be deprived of that water as it would be worth from 500*l.* to 1,000*l.* a year to his works?—There would be no objection to that, provided that between the two points there was no accumulation of filth on the bank of the river; but if there was anything of that kind I should very strongly object to a diversion of the stream.

4245. (*Professsor Way.*) Provided that five or six mills could more easily deal with the purification of the water than one, and that the arrangement did not interfere with water power, there would be no objection to it?—I should think not.

4246. (*Chairman.*) That would be a matter to be carried out by the local authorities?—Yes.

4247. (*Professor Way.*) Every case must be met upon its own merits?—It must.

4248. There would be no real injury to any person if it were found more practicable to deal with the refuse of several mills united than with the refuse of each mill separately, provided the water power was not interfered with?—Just so, if you did not interfere with the water power, and did not allow any other nuisance.

4249. The object being to purify the water?—Yes.

4250. (*Chairman.*) You know the Aire and Calder district?—Yes.

4251. The whole basin of the Aire and Calder is very much larger than is depicted upon that map. This is a small portion of it?—It is.

4252. Do you think that it would be more advisable to break the basin up into a number of areas like that, and to put each under separate jurisdiction, or to treat the whole Aire and Calder district as one district for purification purposes?—That is rather a difficult question. Of course a board of that kind would require to take into account the special circumstances of each district, and it appears to me that it would be a better course to allow the Government to be confined to the local district.

4252*a*. If you look at that map you will see that there is a compact district of which Huddersfield is the centre?—Yes.

4253. If the manufacturers in that district had the power of voting for representatives, the local board for that district could sit in Huddersfield, or wherever it chose to sit, and could legislate or direct for that district, and one surveyor could act for it?—Certainly.

5254. And that board would levy rates for the improvements within that district?—Yes.

4255. And then the local board might be subject to the supervision of a Conservancy board, having power over the whole of the sub-districts?—Exactly; that is my idea.

4256. Supposing that there were 50 local districts similar to this one within the Aire and Calder basin, do you think that those 50 districts should have their representatives at a board which should embrace the main streams and the main area?—That is a matter of opinion, and it is a question upon which I have not quite made up my mind, but as a rule I am in favour of each locality managing its own affairs; one such for instance would be the locality indicated on this map.

4257. That is what I am suggesting, so that you would not have only one locality in the Aire and Calder basin, but as many as the formation of the country would allow to be mapped out?—Yes.

4258. (*Professor Way.*) When the Calder reaches the outline of that map your jurisdiction would cease?—Yes.

4259. Supposing that the lower district had a cause of complaint against you for not carrying into effect fully the provisions of the Act, in what way would they obtain a remedy if there was not a general board?—I think that there must be some court of appeal to decide causes of difference between local districts, but it would merely operate as a court of appeal.

4260. (*Chairman.*) In France there is a board of roads and bridges, and the whole of the rivers and roads in France are under Government surveillance?—Yes.

4261. The municipal authorities have no power to appoint an engineer or to discharge him. Whatever is done to the rivers is done by some government officer. I suppose that you would not like to have that kind of authority set up over you?—I should not like it in Yorkshire; it is not in accordance with our English habits and customs.

4262. You would like to see your way to keeping representative institutions?—We should.

4263. (*Mr. Harrison.*) I presume that in any Act of Parliament which was passed there would be two distinct parts; the first would be to determine what the nuisances were which should be abated, about that there would be considerable discussion?—There would, no doubt.

4264. But if Parliament decided that such and such materials should not be thrown into the river, for instance, if they determined that sewage and ashes and soap-water refuse should not be turned into the river, it would then remain that there should be some supervision of the river so as to carry out the intention of Parliament. Might not an inspector or inspectors be appointed by the county magistracy to have for their duty to summon people offending?—Yes, that is really in effect leaving the matter in our own hands in our own district.

4265. Have you not in the county magistracy a body able to carry out the whole system?—Do you mean to constitute a board?

4266. No; just in the same way as the magistrates appoint the county surveyor of roads. They might appoint a surveyor or surveyors of rivers who would have the power of summoning persons whom they found infringing the Act of Parliament?—There could not be the slightest objection to that.

4267. Otherwise, if you left it to local parties to take action the people inhabiting the area of the Colne might not fully carry out the Act, and their proceedings might operate to the great disadvantage of Dewsbury and Wakefield without a remedy very easy to be applied?—When you refer to the magistracy am I to understand you to mean the whole body in Quarter Sessions?

4268. The county magistrates with an appeal to Quarter Sessions?—With regard to Huddersfield we

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have only county magistrates here, and therefore you would appeal to them?

4269. Of course.—I should have no objection to that at all.

4270. (*Chairman.*) Do you think that it would be advisable to let country gentlemen, country magistrates, legislate for manufacturers?—I do not understand that it would be legislating at all, it would be merely appointing an inspector of the rivers.

4271. (*Professor Way.*) You know the form in which the Thames Act has lately been carried out?—I do.

4272. There were two bodies on the Thames, the Commissioners on the Upper Thames, and the Conservancy of the lower Thames?—Yes.

4273. By the Act which passed through both Houses in the last session these two bodies are merged into one, the present Conservancy with the addition of five members to its number, and this board is now the ruling body of the whole Thames?—Yes.

4274. Would some arrangement of that kind be necessary for the rivers Calder and Aire?—I should prefer subdivisions of the districts under the local authorities.

4275. But you must have some controlling power over those local authorities?—I would have some court of appeal to which to resort in the event of an infraction of the Act of Parliament, that court of course should be able to decide the whole question.

4276. (*Chairman.*) You might appeal to the Home Office or to the Board of Trade?—Yes, you would appeal to that court, whatever it might be.

4277. (*Professor Way.*) But there might be degrees. One district, like your own, might be more anxious to do their duty than another, and it would be difficult to decide upon what was the general advantage of all unless there was some body whose duty it was to look over the whole district?—We say that "The law is for the lawless and the disobedient." If people were anxious to do their duty there would be no need to appeal to any court. If any district did not do its duty I would have it compelled to do its duty by reference to a court of law.

4278. I think that you have stated that any voluntary action is out of the question?—You cannot depend upon it at all, at the present time, it is out of the question.

4279. If it be so, and if you had legislative interference with your full sanction in the first instance, unless there was some means of carrying out that legislation, you would be under the voluntary system still?—I will suppose that you get an Act of Parliament to regulate the whole district or to regulate a portion of the district, and that that Act of Parliament empowers the county magistrates or any other body to appoint an inspector of rivers, the inspector finds that certain parties are not doing their duty, and are not obeying the law; he at once cites these parties before the proper tribunal, as in any other case, to compel them to do their duty; the thing seems to me to be very simple.

4280. Probably the difficulty in the case of the county magistrates would be this, that the dissension would be between district and district and not between party and party in one and the same district. For instance, you might have sufficient power in Huddersfield in that watershed to keep your own concerns in order, and you might have an officer who would take measures in case of any infraction of the law as laid down for the regulation of that district. But how would the general officer deal with the several districts?—It appears to me that any difficulty of that kind would be got over by appointing a river inspector for the whole district.

4281. Do you mean an inspector appointed by the Government?—I do not care whether he is appointed by the Government or in any other way.

4282. (*Mr. Harrison.*) He might be appointed as inspector of prisons?—I should personally prefer that he should be appointed by the magistrates.

4283. (*Chairman.*) As bridge masters are appointed?—Yes.

4284. (*Professor Way.*) Your object is to take individual action out of the question?—The case is a very clear one; voluntary action has done nothing; we have a polluted river, and therefore to leave it as it has been in past times would be to leave it to get worse, and to aggravate the evil.

4285. And legislation would equally be a dead letter unless you provided means to carry it out?—You must have an inspector.

The witness withdrew.

Mr. G. W. Farrar.

Mr. George William Farrar (Honley) examined

4286. (*Chairman.*) You are a dyer?—Yes.

4287. Where are your works situated?—At Honley.

4288. Are they upon the edge of any river or stream?—It is the river which leads to Meltham, commonly termed Magdale or Mag river.

4289. What number of hands do you employ?—26.

4290. Have you any idea as to what volume of water you use in a day?—About 126,000 gallons in 12 hours, we only work 12 hours, from 6 to 6.

4291. Where do you obtain that water?—From springs.

4292. From springs on your own premises?—No.

4293. From springs on some adjoining premises?—Yes.

4294. Not from the river?—Not from the river.

4295. Is it good soft water?—Yes.

4296. What material and what colours do you generally dye?—We dye cloth and wool; the colours are principally blue and black.

4297. What material do you use to produce those colours?—Indigo and logwood, with certain other things.

4298. Chemicals of some kind?—Chemicals to produce the black.

4299. Do you use much soap in washing the goods?—No, very little.

4300. Is the whole of the water which is used more or less polluted before leaving your premises?—Yes, more or less.

4301. What do you do with it after you have used it?—We turn it into the river.

4302. Do you use steam power?—Yes, but we do not require much power of any kind.

4303. What do you do with the ashes from your steam-engine?—They are partly used upon the road repaired by the township where we live; we have about 200 or 300 yards of road which we repair with those ashes, and we turn the remainder into the stream passing by, just as other people do.

4304. Where does the night-soil from your work-people go?—On to the land adjoining.

4305. Have any complaints been made by persons below you of your polluting the stream?—No.

4306. Are there any mills situated above you?—Yes.

4307. You are not at the top of the stream?—No; there are parties above, but they do not spoil the water.

4308. And you do not injure it for any persons below?—The beck goes immediately into a broad stream; the river runs on three sides of the premises of those below us.

4309. What stream is that?—We call it the Mag River, the Meltham Dyke, it is often known by the name of the Meltham River.

4310. Have you ever thought of trying whether you could diminish the volume of impure water before passing it away?—No.

4311. Or whether you could diminish the impurity of the water before passing it away?—No.

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4312. You have had no complaints made against you?—None.

4313. Have you ever put the waste water upon land for irrigation?—We do take the refuse after the process of dyeing blue, we apply all the sediment, that is to say, the woad and the bran and the lime which are used in the production of the colour, we preserve all that and put it upon the land; we have tanks about four yards square in which we put the liquid and allow it to settle, the sediment goes to the bottom, and the top passes off and goes into the river; we take out the sediment and put it upon the land.

4314. Is the water which flows into the river of the colour of any of these samples?—Yes; it will depend a good deal upon the tank, whether it is full or pretty nearly full, or whether it is used just after having been emptied.

4315. Do you turn out refuse something like this (*pointing to one of the bottles*)?—Yes; of course the liquid stays in the tank and gets the eaves droppings of the premises into it, and it stays sometimes till the tank gets nearly full, and runs off moderately pure for a very considerable time. If any particular quantity of sediment goes through, of course we lose that quantity of manure, and therefore we stop the flow through that tank and turn the liquid into another tank till the first is emptied.

4316. What weight of indigo do you use in a year?—That partly depends upon the state of trade and the colours prevailing at the time; we use about a chest and a half a week, the average weight of one chest would be 2½ cwt.

4317. (*Professor Way.*) Is that at about 6*s.* a pound?—It is 7*s.* now. A chest averages from 250 to 280 lbs., some chests are very large and weigh 3½ cwt., but upon the average I should say that we use near upon 400 lbs. in a week.

4318. (*Chairman.*) What weight of woollen goods do you dye with that quantity of indigo?—They vary in weight very considerably, there are some pieces, what we call ends of cloth, which weigh only a small weight; there are some classes of goods which weigh 30 lbs., that applies to broad cloth, perhaps 50 yards only weigh 30 lbs.; some pieces which are 40 yards weigh 80 lbs., therefore I am not prepared to give the weight of the cloth.

4319. (*Mr. Harrison.*) You are not prepared to say what weight of wool and cloth you dye in a week with the 126,000 gallons of water daily?—Our average dye of what we call common colours would be about 1,500 to 1,800 lbs. a day, of wool of that sort, and of the other would be about 1,000 lbs.

4320. Does that include the pieces?—That would include the pieces, I believe, so far as my recollection serves me now as to the weight.

4321. In your opinion, would that be about a fair average of water used for that weight of wool?—Yes. We do not wash the wool previously to sending it away from our dye-house, but we have to wash the cloth, and consequently a greater amount of water is required to cleanse that cloth.

4322. (*Professor Way.*) Is all this wool indigo dyed?—No.

4323. That is not the quantity of wool which this quantity of indigo refers to?—No. 1,500 lbs. of cloth and wool we should dye every day blue in various shades.

4324. With indigo?—Yes.

4325. Therefore this 400 lbs. of indigo a week refers to 1,500 lbs. of wool and cloth a day?—Yes.

4326. Can you tell what quantity of water is used specially for that purpose?—No, because we use the liquid over again repeatedly for a couple of months.

4327. (*Chairman.*) I suppose you are aware that you lose a good portion of your indigo; that it goes away from you?—Yes, a considerable portion does.

4328. Have you ever tried any process of getting it back again?—I have often heard it spoken of, and I should like to see it, because after taking all the impurities away it would be a valuable article if we could get it back again.

4329. (*Professor Way.*) You calculate that not above 50 or 60 per cent. of the indigo of commerce is really indigo?—Just so.

4330. Do you believe that there is as much as that?—I have heard it so stated, but I have never tried it myself.

4331. (*Chairman.*) I suppose that there is a large quantity of dirt in it?—A great quantity.

4332. And if you could get back the indigo extracted by chemical means from the refuse water you would get purer indigo?—Certainly.

4333. They are getting it back by a process at Wakefield to a very considerable extent?—By what means?

4334. (*Mr. Harrison.*) They get the soapsuds and they extract the soap and the oily matter, and from the cake which is left, which in ordinary cases is sent out for manure, the indigo is extracted?—Is the process remunerative?

4335. (*Chairman.*) The indigo recovered is worth more per pound than the indigo which they buy in the market?—It may be worth more, but will the quantity which they obtain make it pay?

(*Chairman.*) Yes, it pays.

4336. (*Professor Way.*) I suppose, if you saved the indigo which is now wasted, it would not be so valuable, because indigo would go down in price?—Supply regulates all matters.

4337. You use 400 lbs. of indigo per week to 1,500 lbs. per day of wool and stuff, that is 5 per cent. Do you think that there is 5 per cent. of indigo in the cloth or anything near it?—I am sure I do not know. I never tried the experiment.

4338. (*Chairman.*) Do you think that 100 lbs. of cloth when it is dyed indigo colour would weigh 105 lbs.?—Certainly, indigo does produce the greatest weight. Manufacturers all know that blue will make the greatest weight; it always increases the weight.

4339. (*Professor Way.*) Then you do not believe that a great quantity of indigo is lost?—No.

4340. (*Chairman.*) As you have not been interfered with, I suppose that you do not feel this nuisance of the rivers which the other manufacturers do?—Certainly not.

4341. Then you are not in a position to give any opinion whether the pollution of the streams should or should not be prevented?—It does not affect me in the slightest degree.

4342. You complain of no one and no one complains of you?—No.

4343. But if there were general regulations for the purification of dye water, do you think that you would be left alone?—I should certainly come within the Act in that respect, but I think that it would be almost impracticable for myself. For instance, the river runs round my premises, and I have not an inch of land on either side, and on the other side there is a hill and the land belongs to somebody else, and I want to know by what means I must purify this water if I am compelled to do it.

4344. If you are asked to do a thing it must be something which can be done?—If they were to show me how I could do it, and if I could get the land to do it, it would be a different thing.

4345. (*Professor Way.*) Would it be possible in any place where you are circumscribed for space to use the basement of the mill for subsiding tanks? No part of your mill is underground, is it?—The greatest part of our vats and pans are below the level of the ground.

4346. Do you mean under the level of the ground?—The vats in which we dye blue are below the level of the river.

4347. Then you have no space to spare there?—No.

4348. (*Chairman.*) Does the river ever flood you?—Yes, and it dams up the drains.

4349. Has it ever blown your vat out?—It has raised one, but only one. We have had one raised six inches.

4350. Have you heard of vats being raised in other

places by floods?—Yes, I have seen them completely turned out. In consequence of the bursting of the Bilberry reservoir at the Holmfirth flood there were several turned out, but that was an unusual occurrence. In our locality we have had one place full half a yard deep all over the floor in consequence of a simple storm and excessive rains from the Meltham district.

4351. That was not from the filling up of the river bed?—No; but the river is too narrow, and everybody encroaches upon it, and when there is an excessive flood it overflows the banks.

4352. Do you think that it is necessary that there should be some jurisdiction to prevent the encroachments which you speak of?—I think that that is desirable. The local authorities ought to prevent them.

4353. Have you a Local Board in Honley?—Yes, but it has only recently been established.

4354. Are you a member of it?—Yes.

4355. Have you carried out any sewers?—No, we have done nothing in sewerage since the formation of the Local Board.

4356. If you sewered, would it be into the stream above you?—No; the drainage runs on the other side of the town. The town or village in which we live stands upon a hill, and slopes down to the river Holme.

4357. What is your population?—Nearly 5,000.

4358. Is it a growing population?—It is not.

4359. Have you anything further to add?—All that I have to say with respect to this inquiry is that my opinion is that a great portion of the complaints which I hear with regard to the bed of the river being raised is in consequence of the quantity of ashes and excavations from new buildings which are poured into the river, and I think that if that were stopped the river would not be obstructed, and that consequently the amount of water which comes down, although it might be polluted in our district, would not be prevented from carrying away with it many of the impurities which now accumulate. For instance, ashes, which are very porous, and which in a dry season soon begin to smell.

4360. You think that the solids ought to be kept out of the river?—Yes.

4361. But you think that the coloured refuse and the dye water will not do any harm?—I do not say so. The dye water, of course, is an objection, and I want somebody to devise a means to regulate that, but I am speaking of the evil of raising the bed of the river.

4362. If you were shown means, within your power to adopt, for doing away with the nuisance of discolouration, would you object to adopt them provided you were only required to do what all the dyers in the county were?—I certainly should not object to that. We want all to be put upon the same footing, as we have the same market to contend with.

4363. (*Professor Way.*) I suppose that you are one of the largest indigo dyers in the district, are you not?—I am. There are several more besides myself.

4364. Is not dyeing by logwood much more common in this district than indigo dyeing?—Yes.

The witness withdrew.

Mr. James Robinson (Honley) examined.

Mr. J. Robinson.

4365. (*Chairman.*) You are a dyer?—A dyer and millowner.

4366. Where are your works situated?—At Smithy Place in Honley.

4367. What number of hands do you employ?—From 100 to 120.

4368. Do you know what volume of water you use for dyeing?—I do not. I have never made so minute an examination.

4369. Where do you get the water?—We get the water from private sources for the purpose of dyeing. Some years ago, in consequence of ochre water or coal water spoiling the stream, a great many of the manufacturers in the valley suffered very considerably in dyeing, and we had then to resort to other means of procuring water, which would enable us to carry on our trade. We procured water higher up in the stream and piped it for a mile.

4370. Then you bring down water from a spring for something like a mile by pipes?—Yes.

4371. Through earthenware or iron pipes?—Earthenware pipes in the main.

4372. Of what diameter are they?—Six inches.

4373. How much of those six inches is occupied by the flowing water?—About half.

4374. What is the fall from the head down to your works?—From 16 to 18 feet.

4375. Do you use steam power?—Yes.

4376. What do you do with your ashes?—They go on to the highways.

4377. Do any of them go into the river?—Not often.

4378. What is the name of the stream on which your works are situated?—The Holme River.

4379. The Holme which flows by Holmfirth?—Yes.

4380. Do you for power avail yourself of the water which comes down the Holme River?—Yes, we have water-wheels.

4381. How long have your works been upon that stream?—More than 50 years.

4382. Then they were there at the time of the Holmfirth flood?—Yes.

4383. Did you suffer at all from that flood?—Very considerably.

4384. Did it do you any serious injury?—Yes, we had more than 2,000*l.* damage from that flood.

4385. Do ordinary floods injure you?—No, except in case of very continuous heavy rains.

4386. Has the river bed, opposite your works, been raised at all since you can remember it?—Yes, from precise observation, I think that it is from six to nine inches higher now than it was 40 years ago.

4387. What works are situated above you?—There are many mills and dyeworks, I should think 50 and more.

4388. Do they pollute the river very much?—Yes, very materially.

4389. Supposing that you had to carry on your dyeing operations with the river water, could you do so?—Not well.

4390. If you had not this private water you would be very much inconvenienced?—Yes.

4391. What colours do you usually dye?—Black and blues, and various other colours.

4392. Do you use much indigo?—A little, not so much as we have been accustomed to do, ours are principally blacks and other common colours.

4393. Do you use logwood?—Yes.

4394. And other woods?—Yes.

4395. What do you do with the refuse wood?—We burn it as a rule.

4396. Do you throw some of it into the river?—Perhaps some may have been thrown into the river, but as a rule we do not profess to throw it into the river.

4397. Where does the soil refuse from the privies, from the working population, go?—It goes on to the land.

4398. Not into the river?—Not into the river.

4399. Do you know about what volume of foul water you turn out into the river?—I could not state that.

4400. Do these samples (*pointing to the bottles*) represent anything like the refuse water from your works?—Yes. So far as regards the darker one, it is something like what is turned out from the dye-house, but the other is like what goes from the mill, and is run forward into tanks; there it is allowed to settle, and the sediment is thrown down by a chemical process.

4401. I suppose that you get the waste soap and oil out of it?—We do not get it, we let it off.

4402. Some other person gets it?—Yes.

4403. How long has that system been carried on?—Several years, nine years I should think.

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4404. You receive a payment for that water?—Yes.

4405. Did you lease the right for a term of years?—No, we give no lease, it is a voluntary yearly arrangement.

4406. Does the person pay you according to the amount of matter which he gets out, or a lump sum?—It is so much per annum.

4407. Have there been any complaints by those persons below you, of your fouling the river?—No, we have had no complaints made to ourselves.

4408. Have you complained of the people above you?—We have complained on account of material thrown into the water, or at times on account of our neighbours higher up in the valley throwing in excavations and matters of that sort; that has been very considerably done.

4409. They have put in excavations and solids of that kind?—Yes.

4410. And those come down and affect you?—Yes.

4411. What reservoir room have you?—Ours is more a goit—perhaps half an acre.

4412. How often do you cleanse it out in the 12 months?—Not more than once.

4413. And you flush it into the river?—We draw the water off every week.

4414. But do you send out the mud every week?—Only what the water takes.

4415. Only what the water takes when drawn off?—Yes.

4416. What is your opinion with regard to the present state of the river, and its being continued?—There is no doubt that the river is in a very bad state, especially for manufacturers. As regards dyers it is impossible for them to do the business profitably or well in the present state of the river, if they have no other water to fall back upon. But in our valley, I think, since we had the injury which arose through the coal water getting in some years ago, most of the manufacturers and dyers have resorted to other means of providing themselves with water with which they can dye.

4417. At what point was that ochrey water sent in?—At the very highest point.

4418. From some coal workings?—Yes.

4419. To whom do they belong?—To Mr. Tinker.

4420. Did that ochrey water spoil any of your pieces?—We had some colours spoilt at the time. Of course it put us to a great deal of inconvenience as well as many other persons all down the stream.

4421. Do you know whether any actions were threatened?—I think there was something of the kind attempted, but the attempt failed, and the thing settled down.

4422. Does ochrey water come down now?—Not to the same extent. There is always more or less arising from the coal workings; we have several coal workings up the valley, and of course they are obliged to discharge it; they have no other means whereby they can get rid of the ochrey water.

4423. Do you think that it would be advisable to put the rivers under some sort of superintendence or supervision in order to prevent this fouling and neglect?—I think that it would be very desirable if the water could be kept more pure, and if any reasonable means could be instituted whereby the different proprietors on the water could be got to keep out the refuse, and as much of the impurities as possible.

4424. Of course for your purposes you would rather have a smaller volume of pure water than the present volume of impure water?—We require as much water as we can get.

4425. For your power?—Yes.

4426. And for that purpose I suppose dirty water is as effectual as clean?—Just so; it weighs the same.

4427. It weighs heavier?—Yes, but the difference is very imperceptible.

4428. (*Mr. Harrison.*) Do you turn the whole of your soap refuse from the washings into the tank?—Yes.

4429. What is the character of the water which is let off from those tanks?—The sediment is thrown down, and when it has gone down the top water is run off; it will of course have more or less of acid in it.

4430. Is that dark liquid (*pointing to the bottle*) a a fair sample of the water?—I do not think that the liquid run off from our tanks is anything like so dark as that.

4431. (*Professor Way.*) But it is not transparent?—No.

4432. (*Mr. Harrison.*) You have stated that every week you let the water flush out the goit, but that once a year you do more; what do you do upon that occasion?—We cleanse the sludge out, so that we can get the water better to the pipe which supplies the engine for condensing purposes, and we have a water-wheel. A body of water is turned out, and the mill is moved and flushed, so that it gets out of the bye-wash.

4433. It goes down to your neighbours?—It goes down to our next neighbours. I suppose that they get a portion of it as we get it from others.

4434. (*Chairman.*) How long have you had your Local Board established?—We are in the second year.

4435. Have you carried out any drainage?—The village is drained; there is somthing like a mile and a half or two miles of drainage, no village is better drained.

4436. Where does the outfall go to?—Into the river.

4437. Are there any waterclosets turned into it?—I think that in our district we scarcely have a water-closet which goes into the drainage because they cannot get water.

4438. Where does the night-soil go to?—I apprehend that it goes into private cesspools and on to the land.

4439. The people have private cesspools attached to their houses?—Most of them have.

4440. And the cottages, I suppose, are numerous?—Yes.

4441. Do you know what the death rate is in that village?—I do not remember just now.

4442. Do you consider yours a model village?—No, I do not think that we are at all a model village. I wish that we were.

4443. Do you find any advantage from your local government?—Yes; we think that it is an advantage to us.

4444. You can cleanse your roads?—Yes; we have more jurisdiction, and better attention is given.

4445. Have you lighted the district?—Yes, the village partially.

4446. Does the central government interfere with you oppressively?—No, I do not know that they do. We have been very leniently and liberally dealt with in that respect so far.

4447. Have you had any inspector down upon any occasion?—We had an inspector down to set out the township into districts.

4448. That is to say to divide it into wards?—Yes.

4449. Who came down?—Mr. Taylor.

4450. Do you find that system work better than having the members from the entire district?—We have members from the whole district, but the plan ensures their being better distributed over the district.

4451. It ensures a better representation of the whole district?—Yes. Every ward has its own members.

4452. As a local board, I suppose you have no power to prevent nuisances going into the river?—None whatever that I am aware of.

4453. Not beyond your jurisdiction?—No.

4454. All plans are submitted to you before houses are built, are they not?—Yes, but I am sorry to say that we have not much improvement going on in that respect.

4455. You have not much building?—Not at present. We have too many houses empty already.

The witness withdrew.

HUDDERSFIELD.

Mr. J. Haigh.

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Mr. JOHN HAIGH (Honley) examined.

4456. (*Chairman.*) You are a colliery proprietor?—Yes.

4457. Where is your colliery situated?—We have a small colliery in Thurstonland which abuts upon the township of Honley.

4458. What weight of coal per day do you raise from your shaft?—It is not a shaft; it is an incline. We are employing about four men at it at present.

4459. It is a very small colliery?—Yes.

4460. Does any water flow out of it?—A little.

4461. Do you pump it?—No.

4462. It flows out from a heading?—Yes.

4463. Is the coal which you are working on the rise?—Yes. The incline which we have driven is on a level, and it intersects the coal in this way (*describing the same*).

4464. And you work upwards and bring it out at the heading?—Yes.

4465. Therefore any water which it makes flows out?—Yes.

4466. Is that water ochrey?—Out of one seam it is.

4467. Does it go into the river?—Yes.

4468. Have you had any complaints as to its effect upon the river water?—No. Very little water flows out of that seam of coal which we are working now in consequence of the workings being small. Formerly, before a line of rails was made up into the district, we had a considerable quantity of coal, but now the coal is principally supplied from the thicker seams. Our seams are very thin.

4469. Of what thickness is that particular seam?—From 16 to 26 inches in our district.

4470. What do you call it?—The Halifax hard, or upper bed.

4471. Is it good coal?—For the description of coal it is.

4472. It contains some sulphur, I suppose?—It does; the lower seam is free from sulphur, and the water is particularly good, fine, and soft.

4473. How near are you to the river?—From our outlet the river is perhaps 300 yards off.

4474. Have you anything to do with polluting the river?—Nothing beyond what may be said as to that quantity of ochrey water.

4475. You do not put anything solid in?—No.

4476. Have you any remarks to offer to the Commission relative to the prevention of pollution of rivers?—Certain observations have been made respecting the ochrey water, but the water of an ochrey description now flowing is much less than it was formerly. Some 40 years ago it was much worse, and it affected the stream much more than it does now.

4477. I suppose that the ochrey water simply flows out in the prosecution of your mining?—Yes.

4478. Would it come out whether you excavated the coal or not?—It would, either directly or indirectly.

4479. You do not create anything, but your operations are confined to the actual raising of coal?—The water becomes worse if they take the coal out.

4480. For a time?—For a time.

4481. Does the ochrey element in the water go off after a time? Supposing that you exhausted that mine, would the water improve by being left to itself?—Yes; it would be less offensive, and less injurious.

4482. Your working and disturbing the seams brings more water out?—The worst part is the stratum lying immediately above the coal, when that becomes exposed to the atmospheric air, though very hard of itself when wrought and forming a good wall to bear up the stratum above, it will become so soft that you can mould it like clay, and the water stopping upon it will become red, comparatively, like blood. When this water is let out it is injurious; but if the seam is not interrupted at all the water runs off so that you would scarcely perceive that it was water from a mine.

4483. Do you think that if the water from your mine was allowed to flow into a shallow canal, where it could be exposed to the atmosphere, a great portion of that sediment would remain?—So far as the ochre is in it, the ochre would descend and remain.

4484. And the better part would flow away?—The clearer water would flow away and the ochre would remain.

4485. Would it be difficult for you to make the water flow through a parallel trench of that kind so as to take the ochre out of it?—Yes, it would. We enter the extremity of the owner's property when we work a colliery; we take all the level that we can at as low a point as we can, so as to intersect the mine at as great a distance as we possibly can. We should have to purchase the land for the deposit.

4486. Is the land very dear with you?—No, I do not know that it can be considered very dear.

4487. What is it worth an acre?—From 100*l.* to 150*l.*

4488. Is it moor land?—No, it is good pasture land.

4489. Has it ever been suggested to you that you should take some means to prevent the ochre from getting into the river?—No.

4490. Have you ever been threatened with actions for spoiling the water?—No.

4491. Have you known any of the colliery proprietors to have been threatened with actions, or to have had actions brought against them?—Something was stated to Mr. Tinker at the time of the outbreak which has been mentioned, but I do not know that any actions were commenced.

4492. Was that a sudden outbreak from old workings?—Yes.

4493. Has that ceased?—It ceased immediately, as soon as the water was run off. In the ordinary course that water would have passed by Thurston and Penistone and the summit of the hill, but Mr. Tinker in working coal hauled into former workings from whence this water was discharged, and this water had been accumulating in the mine for a considerable time, and then the matter out of the shale had so impregnated it that it produced injurious effects in the river. But in our water there is such an amount of softer water from the bed below that the injurious portion is scarcely perceptible; when it comes out there is five or six times the quantity of good soft water mixed with it, and there are other circumstances which have changed within the last 14 or 15 years, the water is less disturbed and runs out mixed with such a great amount of soft water that the inconvenience is not felt in our immediate neighbourhood, viz., in Thurston and up to Fulstone. I have not gone up the river for the last 14 years to make any examination, having nothing to do with the river in any way whatever.

4494. At the time of the outbreak were not the streams up the Newmill Valley very full of ochre water?—Yes.

4495. Does not that continue still?—It is not so bad as it was. Up the New Mill Valley there is a good deal of ochrey water, but it is not so bad now as it was then; more water from the lower bed of coal which is perfectly good and soft water is mixed with the ochre water and makes it less injurious.

4496. But still it is injurious?—Yes.

4497. At the time when the outbreak took place was not there a good deal of ochrey water from your pits?—No.

4498. There was some?—Yes.

4499. Did that water flow into the river?—Those pits are deeper now; some ochrey water comes in, but it is mixed with a very soft water.

The witness withdrew.

Mr. Joseph Crosland (Lockwood) examined.

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Mr. J. Crosland.

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4500. (*Chairman.*) Are you a mill owner?—Yes.

4501. Where are your mills situated?—We have two mills, one at Lockwood and the other at Crosland Moor.

4502. Your brother is member for Huddersfield?—Yes.

4503. Yours is the largest mill near the toll-gate in Lockwood?—Yes.

4504. What number of hands do you employ in that mill?—About 300.

4505. The river there is, I think, the river Holme?—Yes.

4506. You obtain water for your purposes from the river Holme?—Yes.

4507. And you have a lodge there?—Yes.

4508. Do you both wash and dye?—No, we only wash goods.

4509. In what condition is the water when you have washed with it?—It is of course impure, it is much sullied.

4510. Is it the colour of this sample?—Not quite so bad as that.

4511. Is there much soap used with the washing?—Yes, but the soap and oil are afterwards extracted.

4512. How long has that been done?—About 10 years I think.

4513. Do you use both water and steam power?—Yes.

4514. What do you do with your refuse ashes?—Formerly we put them into the river, but lately we have not done so; we have used them with lime for building purposes, and now what the railway people do not take away we deposit upon some spare land near the mill.

4515. You do not put them into the river?—No.

4516. Where does the soil from the closets belonging to your mill go?—It goes into the river.

4517. Would it be difficult to retain it and to use it upon the land?—Of course it would require special arrangements.

4518. You would have to alter your existing arrangements?—Yes. We have about six closets there.

4519. How long do you recollect the river?—15 or 20 years.

4520. Do you think that the bed of the river has risen by accumulations since you recollect it?—Yes, I know that it has risen.

4521. Are your premises at all liable to be flooded in case of heavy floods?—No.

4522. Were you flooded at the time of the Holmfirth catastrophe?—No, not to do any injury, the wheel was in very heavy back water at the time.

4523. But you were up out of the water?—Yes.

4524. The land is elevated there?—Yes.

4525. Of what area is your reservoir?—We have lately divided the reservoir; it was originally about two acres.

4526. You find it necessary to sludge it occasionally?—Yes.

4527. How frequently do you sludge it?—We have not been accustomed to sludge the dam for some years, but last year we divided our reservoir and made one part of it for holding clean water, which is about an acre in extent, the other part, which is about three-quarters of an acre, we use for the purpose of turning the water-wheel for power; that is the river water.

4528. Do you not occasionally sludge it?—No, only to the extent of what the stream takes away every week.

4529. You run off the water on a Saturday night and a sludge bank is exposed on the Sunday?—Yes.

4530. Do you find any injurious effect from that?—No; there were complaints previously to our reducing the size of the reservoir, but I have not heard any since.

4531. Do you never yourself feel any annoyance from it?—No, I am very seldom there when it is exposed.

4532. In hot weather do you not think that it would be liable to give off offensive gases?—Yes, no doubt.

4533. Do you think that there are no means by which you could reduce that amount of offensive matter from the sludging?—By covering it with water or by cleansing it out.

4534. If you cleansed it out it would go into the river?—Certainly.

4535. And your neighbours would have the benefit of it?—Certainly, if there was any benefit.

4536. You receive quite as much as you give?—We receive of course what comes down the river.

4537. I suppose that Mr. Wrigley gives you some of his refuse?—Yes.

4538. Have you ever found fault with him for polluting the river?—No.

4539. Has any person found fault with you?—No, I do not know that anyone has.

4540. What is your opinion with regard to the necessity of any interference with the present condition of the rivers in Yorkshire?—No doubt if some practical arrangement could be made to reduce the impurity of the river it would be advisable to adopt it.

4541. Do you find the water worse for your purposes of washing than it was when you commenced operations there?—Yes, it is much worse.

4542. And I suppose that dirty water is not so beneficial even for washing as clean water would be?—Certainly not.

4543. Do you manufacture a fine quality of goods?—Both fine and coarse woollen goods.

4544. Have you anything to add to, or anything to correct, in the evidence you have heard given during the inquiry?—I am told that a witness said that water for steam power was worth 50*l.* per horse power per annum. If that evidence was given I think that it is faulty.

4545. Have you any idea what you value your own water power at per horse power?—No, we do not get much water power.

4546. Not now?—No, and we never have done so.

4547. What would you value your steam power at, or what do you suppose it costs you?—I do not know; I have not run the sum up.

4548. Is it more like 12*l.* or 15*l.* per horse power per annum?—Yes, it would be.

4549. Is there anything further which you would wish to add to your evidence?—With regard to the bed of the river it certainly has been raised by some means or other within my recollection. At the time when we put our water-wheel down it was placed to be quite clear of the tail goit. It is now from 12 to 15 inches in backwater, which of course has been caused by the obstructions at the mouth of our tail goit; in fact by the raising of the bed of the river.

4550. I suppose you have seen that both above and below your mill, drains from the opposite side discharge into the river, and that there is solid refuse of all sorts put in just below you?—Yes.

4551. Scrapings of roads, foundation material, and every kind of refuse?—Yes.

4552. Do you think that that should go on?—Certainly not.

4553. Do you not think that it is injurious not only to yourself but to all persons having to use water either for power or for manufacturing purposes?—Yes, it it must be so.

4554. And if you had to suffer inconvenience by being obliged to take away all the solid refuse which you make, you would be willing to submit to that inconvenience if all manufacturers were treated alike?—Certainly.

4555. Do you ever find any ochrey water coming down the river now?—There is a little at all times, but it is not of that serious detriment which it is on special occasions.

4556. There are special occasions when it comes down in very large quanties?—Yes.

4557. And then it is liable to do you damage,

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you having no warning?—Yes; some 10 years ago, when Messrs. Tinker's works caused a large amount of ochrey water to come down, we sustained very serious damage, to the extent of some hundreds of pounds in two days.

4558. A few months ago do you remember any occasion of that sort?—No. There is one point which I wish to mention to the Commissioners, namely, that we are now to a certain extent independent of the ochrey water, or even of the foul water from the river. By separating our reservoir we have made one acre of it into a clean water reservoir, and between Saturday night and Monday morning at 6 o'clock the water of the river runs very bright, quite clear, and during a part of that time we fill this reserve, which contains something like 1,000,000 gallons, which always serves us for the remainder of the week, so that you may say that we are independent of the foul water during the week.

4559. You are in a very much improved condition?—Yes.

4560. (*Professor Way.*) I take it that when this ochrey water issues from the ground it is really bright and transparent like other water; it is a solution of iron in the first instance, is it not?—Yes.

4561. And by exposure it deposits a red ochre?—Yes.

4562. After that is deposited the water comes down to you comparatively pure, and when it becomes heated it deposits iron, does it not?—Yes.

4563. So that you have no means of judging of the amount of ochre in it?—Not always, but we have actually a large quantity of ochre coming down.

4564. It would perhaps require long exposure before the whole of the iron was deposited?—It would.

The witness withdrew.

Mr. A. Crowther.

Mr. A. Crowther (Lockwood) examined.

4565. (*Chairman.*) You are a manufacturer?—Yes.

4566. Where is your mill situated?—In Lockwood.

4567. Is it below Messrs. Crosland's?—Yes.

4568. What power do you use?—Steam power.

4569. No water power?—No water power.

4570. What class of goods do you manufacture?—Doeskins principally and woollen fancies.

4571. Do you dye?—Yes.

4572. Where do you obtain your water?—From the river.

4573. How long have your works been there?—22 or 23 years.

4574. What is the condition of the water now as compared with what it was when you commenced operations?—It is more impure now than it was then.

4575. What do you do with your ashes?—They are partly thrown into the river, the railway company takes another part, and they are partly used on the roads.

4576. Have you thrown them into the river ever since you established the works?—Yes.

4577. And do parties above and below you do the same?—I believe so.

4578. Where do you discharge your refuse water?—Into the river.

4579. Is it very foul when it goes in?—The dye-water is foul. I find that we pump 155,000 gallons of water from the river in the 12 hours. We use in dyeing about 6,150 gallons, say 6,000 gallons, but we use over 100,000 gallons of these 155,000 gallons in scouring wool.

4580. And does it pass off actually like this sample?—Yes; and the remainder is used in scouring of cloth, boiling of goods, and in finishing generally.

4581. Have you any means of filtration or of deposit so as to purify the water in the manner described by Mr. Crosland?—None.

4582. You are obliged to use the water in its polluted state?—As it comes to us.

4583. How much wool do you use?—About 40 packs of wool per week.

4584. And each pack weighs how much?—240 lbs. Of those 40 packs, about one-fourth upon the average will waste; that is, merely in washing.

4585. You mean in weight?—Yes; that is to say, if we scour the washed wool (not the greasy wool, but the washed wool from Australia) we find that in scouring it will upon the average waste about one-fourth, so that out of 40 packs of wool as imported we have about 30 packs of clean wool.

4586. What is that wool worth per lb.?—About 1*s.* 9*d.* to 2*s.* 3*d.*

4587. Do you use any material besides wool?—Yes.

4588. What do you call it, shoddy or mungo?—Both.

4589. Do you know what weight of it you use?—I do not.

4590. Do you wash it at all?—It would be washed in the cloth.

4591. (*Mr. Harrison.*) And dyed?—And dyed.

4592. (*Chairman.*) Have you no well or borehole, or means of getting other water than what the river affords you?—At the time of the overflow of the ochre water some 10 years ago we bored, but we do not use the water from that borehole at all.

4593. Is it too hard?—Yes, it is rather hard.

4594. Is it ochrey?—No.

4595. Why do not you use it; is it not sufficient in quantity?—We do not suffer very much from the river when we have a season like the present.

4596. Last year, when it was so continuously dry, how did you get on?—We suffer more from ochre water from mines above than from anything else.

4597. Is the water too dark? I suppose that the darkness of it does not interfere with its value?—Not much.

4598. Do you use much indigo?—We use none at Lockwood. We have a small dye-house just above Mr. Robinson's, but that has only been used lately, and I do not think that I can give you any valuable information upon it.

4599. Has the river bed risen much since you commenced your operations?—It has a little.

4600. Does it flood your works?—No.

4601. Then you do not suffer from flooding?—No.

4602. Did the Holmfirth flood do you much injury?—The flywheel of one engine ran in water.

4603. Have you heard the evidence which we have received here as to the necessity of some measures being adopted to put the river in a better condition?—Yes, I have heard a part of it.

4604. Have you yourself formed an opinion as to whether any measures are necessary or not?—I think that with all the ashes and what not which are turned into the river measures may be necessary.

4605. Do you think that the dye water may go in?—If there was any drainage of dye water I think that there would be left no water in the river to pass the mills.

4606. You have recently carried out sewerage works in Lockwood?—Yes.

4607. Where have you made the outlet?—Into the river.

4608. Have you drained many houses?—Yes; a number have been drained in the lower part of the road.

4609. Does the refuse from them go into the river?—Yes, but there are not many waterclosets.

4610. Then it is merely surface drainage?—Yes. I think that we have more closets in Mr. Crosland's mill and our own than perhaps in the whole neighbourhood.

4611. Would it be any hardship if you were told that you must not let the watercloset refuse go into

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the river?—I think that you might say something far worse than that.

4612. What is the worst thing that I could say to you?—To tell me that I must not put refuse and ashes into the river.

4613. Do you consider that it would be any hardship to be told not to put ashes in?—I do not know where we should put them. For the last six months the railway company have taken the whole that we have made, but we consider that we make 600 tons of ashes per annum, and that upon the average we have put 300 of them in.

4614. You have heard the evidence which has been given, that the bed of the river is rising below and is flooding adjacent lands, and it stands to reason and common sense that if solids, such as ashes, are put into the river and bind together they must gradually bring up the bed of the river, so that if you went on for some years you might flood very large areas of land and a large amount of mill property most injuriously, and in fact destroy it?—Yes.

4615. Do you not think that if you and all persons in your situation are dealt with alike, and are not allowed to put ashes in, you will find some use for them or some place to take them to?—We should have to try.

4616. If you had not the river of course you would have been obliged to do something with them?—Yes. The bed of the river opposite to our mill may, perhaps, have risen some 12 or 15 inches in the last 22 years. We have a proof of it from Mr. Crosland's water-wheel.

4617. If the same causes are continued, do you not think that the effect will be continuous, and that if you have raised the bed of the river 15 inches in so many years there is every probability of your raising it further 15 inches?—I think that there is every probability of it.

4618. Do you not think that that is more injurious in its consequences than the cost of removal by all parties of solids which they now throw in? Supposing that you had to cart away the 300 tons per annum of your ashes, what would it cost you?—It would depend upon where we should have to cart them. We shall be very glad to cart them away if any place can be shown to which we can take them.

4619. How long has your board been in operation? About three years and a half. We have partly drained the district, and have lighted it.

4620. And you have put the roads in better order?—Yes.

4621. Do you not use a large quantity of ashes for road forming?—Yes; Mr. Abbey I daresay will know that much better than I do, but I am sorry to say that he cannot take all the ashes away.

4622. Is Mr. Abbey your surveyor?—Yes.

4623. (*Mr. Harrison.*) You have given us very valuable information as to the quantity of water which you use, and the quantity of wool which you dye. Can you tell us somewhat the proportion of mungo you add to the wool, otherwise the information falls to the ground?—We do not use quite so much mungo, &c., as wool.

4624. (*Chairman.*) Your customers know that you use mungo?—I suppose that they do.

4625. (*Mr. Harrison.*) And there is no doubt that it is a very great thing for the country that it is used as it is. It enables you to manufacture a cheap article for labouring men who have nice warm clothing which they could not formerly purchase?—Any merchant who supposes that he can get a good black doeskin at 3*s.* a yard without mungo in it, only displays his ignorance.

4626. (*Professor Way.*) The use of this article now is not in the nature of adulteration, but mungo is a recognized article of trade?—I should say that there is scarcely anybody who does not use it.

4627. It is not considered that there is anything derogatory in the use of it?—I should say not. That day, I should think, has passed by.

4628. (*Mr. Harrison.*) You and other gentlemen have mentioned the ochrey water which is so objectionable?—Yes.

4629. Do you know of any means by which the ochre could be stopped at the source so as not to form an occasion of mischief?—I do not know. since the time previously referred to by several witnesses we have never suffered so seriously from it.

4630. (*Chairman.*) Did it injure you then?—Yes, very much indeed.

4631. It injured some of your cloth?—Yes, we must have lost thousands of pounds worth of cloth which we could neither dye nor do anything else with. In fact, the water was so bad at that time that we could not use it for manufacturing purposes at all. It was an utter impossibility to do so.

4632. Is the water otherwise objectionable besides affecting your dyeing process?—It affects the whole manufacture.

4633. But it does not affect the people on the banks of the river?—No, I do not know that it does. I remember travelling to Honley on a Sunday at the beginning of this year, and the water was quite yellow with ochre, so much so that though it was Sunday, I went to the mill in the evening, and I told them that they must not start till I got there in the morning.

4634. (*Professor Way.*) You said that you made 600 tons of ashes in the course of the year?—Yes.

4635. I suppose that the coal which you use here is the coal of the district. Is it the coal of Wakefield?—Yes, it comes from that part.

4636. Does it produce a good deal of ash?—Not so much as some coal.

4637. Is it red ash or white ash?—It is not a white ash, but it is not very red.

4638. What quantity of coal do you use in a year?—About 100 tons in a week.

4639. The ashes then are about one-eighth of the coal?—Yes; we tried what weight of ashes came in 24 hours away from a certain weight of coal.

(*Mr. Brooke.*) I very much agree with Mr. Crowther. Mr. Crowther made a calculation, and found it to be 600 tons.

(*Mr. Crowther.*) 15 or 16 tons of coal make two tons of cinders, so that the ashes would be about one-eighth of the whole.

4640. (*Professor Way.*) It would be 12½ per cent.?—Yes.

4641. If we know the coal used in factories in this neighbourhood we may take that as a tolerably fair datum of the quantity of ashes produced generally?—I think so.

4642. (*Mr. Harrison.*) And may we take the information which you gave as to the quantity of water used in dyeing and so on, as a pretty accurate statement for the whole district?—Yes, I think that the quantity of water used would be about the same.

4643. (*Professor Way.*) I understood you to say that clean wool when scoured lost 25 per cent. of its weight?—Yes.

4644. That is not all grease, is it?—Three kinds of wool come from the colonies. One is greasy wool in which I have not had much experience, but from the little which I have had I should think that it would waste one-half or 50 per cent.

4645. (*Mr. Harrison.*) And even more sometimes?—And even more sometimes; 60 per cent., I have no doubt. Another kind is washed wool, and that will still lose, after it is scoured here with urine, 25 per cent.; we use nothing but urine. As to the scoured wool which comes from the colonies, some will nearly make its weight and some will lose 5 per cent.

4646. (*Professor Way.*) You know that there was this loss because you dried the wool?—Yes.

4647. But you do not dry the wool before you scour it?—No.

4648. You dry it in a stove?—Yes.

4649. If it is not dried before it is imported its weight would be reduced from loss of moisture?—Yes, but I give it you as we buy it.

4650. But you do not buy it dried?—No.

4651. If you dried it in your hot closet would it lose weight?—I do not know.

4652. I ask that question because it is known that all animal matters contain 10 or 12 per cent. of moisture, so that we should be wrong if we supposed that 25 per cent. of solid matter was washed out of this wool?—I do not know what weight of solid matter does go into the river.

4653. We must not put down that 25 per cent. as something valuable which you could recover from the liquid?—No, I should conceive not. We once gave a quantity of water from the wool washing to a chemist to see whether it contained sufficient grease to be made available in the washing of goods, but there was such a large quantity of water and such a small quantity of grease that he could not see that any profit would attend its precipitation.

4654. Do you separate the grease?—Yes, from the water used in scouring goods.

4655. Do you do that yourself?—No; we have parties who contract for it.

4656. Do they do it on your premises?—Yes.

4657. What is the nature of the liquid which runs away after they have separated the grease, is it a clear liquid?—Not quite.

4658. Is it as bad as this (*handing a small bottle to the witness*)?—Not quite.

4659. Is it nearly so bad as that?—I have never noticed it very particularly.

4660. If it was as bad as that it would come under your notice as a thing which ought to be kept out of the river even after the grease was separated from it?—It is only what may be termed the very best that they deal with. When the cloth is scoured, for example, they only take what comes for a short time, and I should suppose that six times as much water is afterwards used upon the cloth and turned into the river containing a part of the grease.

4661. The water, after the grease has been extracted, is not pure water?—It is not quite pure water.

4662. (*Mr. Harrison.*) One of the witnesses to-day said that he sold his soap refuse, and that the whole of the water which was used in cleaning the cloth was sent into the tanks?—He said that they were putting down tanks of the kind, but I should fear that after experience the matter will be found to be different.

4663. You think that they will object to take the whole of the water?—I do not think that they will turn the whole of it in.

4664. (*Professor Way.*) The persons who contract to take your refuse get as much grease as they can profitably obtain out of it, and are indifferent as to what the stuff is which passes out into the river?—They just get the very best of the grease out of it. First of all the cloth is scoured, then they will take the very best of the oil; then soap is used in the milling of the cloth and afterwards in the washing, and they just take the very thickest of it.

4665. (*Chairman.*) What weight of soap do you use in a week, or in a year?—From 8 to 9 cwt. per week.

4666. What weight of available material is got from your washing refuse?—I do not know.

4667. I suppose that they pay you not upon the tonnage of material which they obtain, but rental fixed by arrangement?—I think that it has been so much per billy or condenser; it was so upon the first onset.

4668. Do you know what they get for the soap which they take out of your refuse?—No.

4669. 18*l.* or 20*l.* per ton?—I think that I have heard that it has been 18*l.* or 20*l.* per ton, but that is not a matter which has concerned us, for we make an agreement for seven or ten years at a time.

4670. (*Professor Way.*) Have they ingress into your premises to do this, or is a part of your premises separated for the purpose?—A part of the premises is separated, but still they come into the mill yard.

4671. Would you think it a very great hardship if you had to lay out upon the purification of the river some of that profit, which you now get from the waste soapsuds?—I do not think that I should. If we can benefit each other as manufacturers, I think it very desirable to do so, if some plan can be suggested.

4672. It may ultimately turn out that the waste products, as in the case of gas water, may be so utilized as that income from one may be set off against loss from the other?—Then there could be no hardship in it.

4673. Excepting that some persons might grumble at a source of income being taken away from them which they now put into their pockets. I do not know what you are paid?—Nothing extraordinary.

4674. 150*l.* a year?—No; some 50*l.* or 60*l.* would be the most for the refuse itself.

4675. We heard of one place where as much as 3,000*l.* a year was paid?—That would be, I presume, in the neighbourhood of Bradford, where they wash the wool and use soap.

4676. (*Chairman.*) Did you hear the remarks of Mr. Wright Mellor as to what means are practicable for the preservation of the rivers and streams in this and other parts of England?—I am not sure that I heard the whole of what he said but I was present during the latter part of the time when he was replying to your questions, and I should agree with his answers so far as I heard them.

4677. How long have you had experience of your local board? Have you been a member of it since its first formation?—Yes.

4678. Have you been chairman since it was first formed?—No, this is the first year that I have been so.

4679. Did you ever hear any objections to local boards as being centralizing boards and that the power would be taken from the district?—There was not very much of that sort of thing said with us.

4680. Have you heard of any objectionable interference by the central board with your authority?—I do not remember any.

4681. Have you ever had any occasion to ask advice?—I do not remember it.

4682. You have to submit your plans to the central board when you are about to carry out your sewerage arrangements?—Yes.

4683. Has any objection been made to them?—I should think not; but Mr. Abbey is better informed upon that point than I can be.

4684. Formerly, before the establishment of your Local Board, persons could build where they liked and how they liked, and could make any arrangements they liked?—Yes, pretty nearly so, I think.

4685. You have jurisdiction over every building of every kind to be hereafter put up in your district?—Yes.

4686. The plans are submitted to your board?—All of them I believe.

4687. And you discuss the arrangements, and if they are not of a proper kind you can object to those arrangements?—Yes.

4688. And I dare say that sometime you do object?—Yes.

4689. Do the parties modify them so as to remove the objections?—Yes; a general disposition is shown to do so, to meet the requirements of the law.

4690. All that they want is information?—Yes.

4691. Do you think that that is beneficial or otherwise to the property of Lockwood?—It must be beneficial.

4692. You yourself are a large ratepayer in Lockwood?—Yes.

4693. And all the members of the board are ratepayers?—Yes.

4694. And it is left entirely to you as ratepayers to govern for the benefit of all the other ratepayers?—Just so.

4695. Do you think that it would be possible to have a local board which would govern in the same way for the river?—I should fear not.

4696. Why?—Because it is a very easy matter for

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a manufacturer to throw his ashes into the river, and there being a number of manufacturers on the board, we perhaps might be more lenient in that respect than we ought to be.

4697. Then your experience teaches you that it is an advantage to interfere with persons who are going to erect property, such as houses, mills, and other things?—Yes.

4698. If all the mill owners upon these rivers were put under restrictions with regard to what they should do with their solids and their fluids, do you not think that it would be an advantage to the whole?—The Local Board, having to deal with the townships, has to deal with every person who wants to build, but in this matter there would be comparatively few who would wish to throw their refuse into the river, and those few would, in all probability, be the parties who would be upon the board.

4699. Do you think that if you were upon a drainage board you would advocate your right to throw your ashes into the river if you thought that you could carry such a resolution?—I do not think that I should; but still we might be disposed to pass by the matter if we had difficulties ourselves.

4700. You might be disposed to look in a very friendly spirit at your own difficulties?—We might.

4701. In a much more friendly spirit than an outside person would?—I think so.

4702. (*Mr. Harrison.*) Do you agree with the proposal of Mr. Mellor?—Yes; I think that that is as good a plan as has been suggested thus far.

4703. That is to say, that if the nuisances which were to be stopped by Act of Parliament were clear and distinct, the county magistrates might appoint an inspector or inspectors, and that they should take up the offender and that he should be summarily punished, with an appeal to the Quarter Sessions?—Yes; I think that that is as good a plan as I have heard suggested.

4704. (*Professor Way.*) You do not believe that any voluntary association of manufacturers will ever lead to that result?—I should fear not.

4705. (*Chairman.*) Then it would be necessary to have a stronger power than you possess as chairman of your local board?—I think that that would be better.

The witness withdrew.

Mr. J. Hopkinson.

Mr. Joseph Hopkinson (Huddersfield) examined.

4706. (*Chairman.*) You are a civil engineer?—Yes.

4707. Practising in what district?—In Lancashire principally, but I have works here.

4708. What do you regard as the annual value of horse-power for steam purposes?—It varies from 10*l.* to 20*l.* and we pay taxes for it in addition.

4709. You put up steam power, and its rental would be from 10*l.* to 20*l.* according to position?—Yes, and according to the room which it occupies; for light machinery we charge 20*l.* for the room and power and we pay the taxes. I have let a considerable amount of that power.

4710. What do you find for that?—Room and power.

4711. And you maintain it?—Yes, and oil the shaftings and everything.

4712. What is the relative value of water power?—I do not know much about water power.

4713. As it is less certain it would be considerably less valuable?—Certainly.

4714. Then you would think that 10*l.* or 12*l.* per horse power for water power would be quite enough?—I should not like to pay that amount compared with steam power, because we find steam for heating the rooms, &c. for the price which I have named.

4715. Have you paid attention to the question of smoke prevention?—Yes.

4716. Do you think that it is practicable to prevent smoke?—I was one of the competitors for the 500*l.* prize at Newcastle-upon-Tyne some dozen years ago, and I believe that I stood second on the list, and during the trials I may say that there was not any more smoke from the chimney than there was from a common cottage chimney.

4717. Do you think that in preventing smoke the process would be injurious to the boilers?—It all depends upon the mode in which it is prevented.

4718. There is a method of preventing it which would not be injurious to the boilers?—Decidedly so; in fact there would not be so much wear and tear of the boilers as with the present mode of firing.

4719. Would it also save fuel?—Certainly.

4720. And could you do it with any kind of coal?—Some coals are much better than others; you require a different mode of firing, according to the different qualities of coal and the different water and the draught.

4721. Do you want more boiler room when you burn your smoke?—No, I generally recommend the making of the fire in the hottest manner that you can, at an extreme heat if you can get one, that is for consuming smoke and saving fuel. The general notion has been that there should be slow combustion, but I have always found that to be the worst plan.

4722. Have you had experience with regard to the special subject of our inquiry, river pollution?—A little; I have lived near the river Holme and I have often complained of my own property situated along the river being very much injured by it.

4723. You think that the pollution should if possible be prevented?—Decidedly.

4724. You are not a local manufacturer?—No.

4725. And you have nothing to do with local manufactures?—No.

4726. Is there anything further which you wish to add?—I would observe upon the question of what can be done with ashes, that my works I think are as large as the works of the last witness, and we do not put any ashes into the river at all, we find parties to come and buy them occasionally.

4727. Where are your works situated?—Upon Colne Road, just by here.

4728. Are they upon the banks of the river?—They are not far from it.

4729. Have you ever put any ashes into the river?—No.

4730. Would any person fine you if you did so?—No.

4731. You find that there is a sale for them?—Yes.

4732. How would you apply them?—For brick making.

4733. Do you use them instead of sand for mortar?—I always have done so myself.

4734. And they make better mortar?—Yes.

4735. Stronger?—Yes.

4736. If sand has value for that purpose ashes have more value?—Yes.

4737. Do you think that they might be used in any way for filtering dye water?—I cannot speak with certainty, but I should think that they might, just as any vitrified matter, as sand, the principle is just the same.

4738. (*Mr. Harrison.*) Have you made any experiments upon the saving of coal by the mode which you employ for consuming smoke?—Yes, a great number.

4739. What was the result?—The result was a saving of fuel of from 17 tons a day down to 13 tons at the Meltham Cotton Mills.

4740. Were the mills doing the same quantity of work?—Yes, I do not say that it was altogether in consequence of the consumption of the smoke; it was from a better mode of firing as well.

4741. (*Chairman.*) In smoke burning the mode of firing is perhaps of as much consequence as anything else?—Yes; if a man who understands the mode of

firing will attend to it, but the attention of the men is the great difficulty.

4742. Then do you not think that a superior class of men ought to be employed, and better wages paid, upon the condition that the men prevent smoke?—Yes, that is what I should consider the best means of preventing smoke.

4743. That good wages should be paid weekly and that a sum should be paid to them quarterly on condition that there were no complaints during that quarter?—Yes.

4744. And that if there were complaints a deduction should be made from that surplus money?—Yes. There was one mode which Mr. Brooke at the Meltham Mills employed some years ago. He fixed a standard of so many tons of coal a week to be consumed, and for every ton saved below the standard he paid the men 1*s.*; in the first month the men had 24*s.* to draw, so that it showed that 24 tons less of coal had been used in that month.

4745. What were the coals worth?—They were then worth about 10*s.* 6*d.* a ton.

4746. Then the proprietor saved ten times as much as the men gained?—Yes.

4747. (*Mr. Harrison.*) What was the gross quantity used?—13 tons a day.

4748. (*Chairman.*) Is there anything further which you wish to add?—I have heard the waterworks mentioned. If we had a more liberal system of waterworks in this town, so that they would allow water for steam engines, particularly small steam engines for warehouses, as much water as they required, the waste water from the engines would perhaps be a means of cleansing out drains and also of neutralizing a great deal of the dirty water in the river.

4749. You mean that it would be an advantage if more waterworks were established in the district so as to bring more pure water into it?—Yes.

The witness withdrew.

Mr. JOHN COOPER (Fartown) examined.

Mr. J. Cooper.

4750. (*Chairman.*) Where do you come from?—From Fartown.

4751. This plan represents some property about which you wish to speak?—Yes.

4752. By whom was this plan made?—Mr. Brook the surveyor.

4753. How far is this property from Huddersfield?—It is about a mile and a half.

4754. Is it above Huddersfield or below?—It is on the north side of Huddersfield.

4755. There is a brook called Blackhouse Dyke?—Yes.

4756. How long have you known Blackhouse Dyke?—All my life.

4757. In what condition is it now?—The water is very much fouled.

4758. What fouls it?—There are manufactories and farmyards and waterclosets.

4759. What population is there in Fartown Green?—There are perhaps about 100 dwellings.

4760. Where do they get their water supply from?—From Blackhouse Dyke.

4761. Is there no other place?—No.

4762. Can they use it now?—They are obliged to use it; there is no other water which they can have when it is foul.

4763. Is Sun Wood House a gentleman's house?—Yes.

4764. Where is the water which is supplied to that house got from?—There is a pump running down into the park, and the water is thence forced up.

4765. Does the owner of Sun Wood House take water from the same Blackhouse Dyke?—Yes.

4766. And that is all the water which he has?—Yes, there are pumps and drain water from the house.

4767. How long has this pollution been going on?—It has been considerably worse since a manufacturing establishment has been set up.

4768. Near the "New Inn?"—Yes.

4769. What do they manufacture there?—All kinds of goods.

4770. To whom does it belong?—Mr. Henry Lister.

4771. Do they dye there?—He does not dye, but he keeps stocks and washes.

4772. His refuse water comes down this brook?—Yes.

4773. And into the Blackhouse Dyke?—Yes.

4774. And it flows down the Blackhouse Dyke till it gets into the river Colne?—Yes.

4775. And it pollutes the water all the way down?—Yes.

4776. Have you complained to any of the local authorities about it?—We have not a local board in our part; there are only local surveyors.

4777. You have not a local board in Fartown Green?—No. The neighbours all complain to each other.

4778. Had you a meeting at Fartown last night? Yes.

4779. Was it put to you, whether you would adopt the Local Government Act or not?—Yes.

4780. How was it carried?—The lower order of the ratepayers upset it altogether, they would not have it.

4781. Then do you think that you can come with a good face to ask others to help you when you will not help yourselves?—We who suffer from Blackhouse Dyke are only a portion of the hamlet of Fartown; the hamlet is very large.

4782. It appears that the people are quite content to remain dirty?—But the majority of those at Fartown have nothing to do with Blackhouse Dyke water.

4783. Where do they get their water?—They have the town's water from the Huddersfield Waterworks.

4784. Could not you get your supply from the town's water?—It has not come into our place; we could get it, but we should prefer having that dyke because it used to be pure water; there is not a purer water than it used to be. If we had a local board we could have drains to convey the refuse away.

The witness withdrew.

Adjourned to to-morrow at 10 o'clock.

Huddersfield, Saturday, 27th October 1866.

PRESENT:

ROBERT RAWLINSON, ESQ., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, Esq. | Professor JOHN THOMAS WAY.

Mr. EDWARD BROOKE, jun., further examined.

Mr. E. Brooke, jun.

4785. (*Chairman.*) You have, I believe, some suggestions to offer as to the prevention of ochrey water, which is so much complained of by manufacturers on the stream?—Yes. I think it occurs in this

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way: the ochrey water comes from the day-holes, generally speaking. I mean from abandoned day-holes, for from day-holes in regular work it is carried off day by day in very small quantities. After the day-holes have been abandoned the water dams up, and perhaps there is a fallen roof in the mine across the road for a distance of 400 or 500 yards, and when the ochrey water is of sufficient weight it forces itself through the shale and runs away into the stream, doing damage of course; after having been pent up it comes out in a much heavier flood. If the mouths of the old day-holes were very securely walled up, the ochre would accumulate to a certain extent, but if air was not admitted, the ochre would not fall to the extent that it does when the day-hole mouths are all open and access is given to the atmosphere.

4786. You think that it would be a great advantage when mines have been worked out to effectually close the day-holes, so as to prevent this escape of ochrey water; any accumulation would be retained in the workings, and there would be only filtration; if any water came out, it would come through the stratification, and although it would still contain some of the iron, it would not be so injurious as the great floods of ochrey water which break down any temporary dam?—I do not think there would be much filtration after the day-holes were securely walled up; if they were sealed up close, the production of the ochrey water would go on for a certain time, perhaps two or three years, but I think that it would then, to a certain extent, cease, because all the workings would be full of water. It is common in collieries to dam back an immense quantity of water, as much as 40 lbs. or 45 lbs. to a square inch, at the back of the dams.

4787. At the present time who would have a right to interfere with those old day-holes?—Government might compel them to be walled up as they compel old shafts to be fenced round.

4788. Government might, by a special provision, do so, but suppose the millowners down the stream who suffer so seriously wished by combination to have those day-holes walled up, could they do it?—I believe that the colliery proprietors would not object, as the expense would not be very serious to them.

4789. Would the water be likely to interfere with the working of any future seams of coal?—No, not in this neighbourhood; they are pretty nearly worked out. There are many old day-holes in the neighbourhood which are left open, and are continually discharging ochrey water. If they were walled up, I think the thing would be stopped.

4790. Do you think that the manufacturers, if they combined together, could now effect that improvement?—I think so. I have not examined the day-holes sufficiently to say what the expense would be, but it could not be very much.

4791. In the event of a board of conservancy being established, do you think that is the way in which they might effect a great improvement in the quality of the water?—Yes; the ochrey water will never cease running until the day-holes are walled up, because as long as you allow the atmosphere to get into the shale, and the water to pass through, ochrey water will form and will keep running out.

4792. Do you think that the colliery owners would consider it a hardship if they were compelled to wall up these day-holes?—Not unless the day-holes to be walled up were connected with the day-holes that they are working. A great many of the day-holes about here are abandoned.

4793. (*Mr. Harrison.*) Would not the work require to be done very securely?—Yes.

4794. The drifts rising from the day-hole upwards and then the workings rising again would probably in a very short time cause great pressure upon the masonry?—Yes; but there would not be nearly the same amount of pressure that there is in all collieries where they dam back quantities of feeders.

4795. Whatever was done must be done very securely, otherwise the remedy might prove worse than the disease, if the masonry were to give way?—Yes.

4796. (*Professor Way.*) The plan you propose is to prevent the formation of the ochrey water. Suppose it is impossible to accomplish that, do you think anything could be done to separate the ochre before it gets into the stream?—Yes. If the discharge from the old day-holes were made to run on, say to a large reservoir, covering an acre or two, the ochre would settle down very quickly, and then it could be carted away at about 5*s.* a ton. We have recently taken to some old workings at Elland; the water is dammed up there, and in the course of two or three years there will be a sufficient accumulation to make it pay to sell.

4797. If the liquid water containing the iron was spread over a large surface to allow the carbonic acid to escape, the iron would separate, would it not, in a great measure from the water?—I have no doubt of it.

4798. Is land to be obtained for that purpose?—In the neighbourhood of the mines I should think it is.

4799. Do you know what quantity of iron there is in this water?—I have an idea that it is very considerable, because there is so much in our own colliery workings that we have to buy the canal water instead of using our own, although we pump 500 gallons a minute.

4800. Are you aware that one gallon would contain as much as three grains of oxide of iron?—I know that the quantity is very large indeed. I think the colliery waters are as bad here as anywhere.

4801. It is your opinion that it is not at all impossible to purify the water if the damming up of the day-holes could not be accomplished?—It is.

4802. (*Mr. Harrison.*) Are the drifts much upon the rise?—Yes; they are generally worked on the rise.

4803. Is that rise considerable?—No; the inclination of the strata in this district is generally about two inches to a yard.

4804. The drifts frequently do not follow the strata?—The rise of the strata is generally an inch and a half to a yard, on an inclination from the mouth of the day-hole.

4805. Is it not possible to make little dams across an abandoned drift at several places, and so form a reservoir or settling tanks within the drift itself?—Yes; and that is the way we do it at Elland. The water settles in a long place of about 300 yards in an old drift that is dammed up at the front. 12 months have now passed, and there are now about four feet thick of solid ochre. We have sold it to a man there at 5*s.* a ton; he takes it out in carts and puts it into a large square hole to let the water settle away from it, so as to be able to put it into his cart, and when it is sufficiently stiff he carts it away.

4806. Have you some drifts now from which the water, after the settling of the iron, has to pass down the valley below?—Yes; that is in the Elland valley, not in this.

4807. (*Professor Way.*) Does the water, after that settlement, deposit again when it comes out in the open air, or are the brooks that come from it red?—I have not particularly noticed that, but I should say, perhaps, if the flow of water is considerable, the first settlement is not complete.

4808. (*Chairman.*) Common sense would suggest that coal owners in working their mines ought, if possible, to be required to work them so as not to injure the property of other people?—I should think so.

4809. If they are allowed to work them in a negligent manner, would it not be wise in future to compel them to work them in a careful manner?—The evil does not arise from the negligence of the colliery owners; I believe that they cannot prevent the water coming out unless they wall the day-holes up.

4810. They can prevent an injury being done if they adopt the steps you have suggested?—Yes. Suppose that a man has taken a lease of 50 acres, and he has worked all the coal out, and his lease is out, he has nothing to do with the ochrey water that comes out of the day-hole.

4811. Unless he were required by law, when his lease had expired, to make the works as secure as science could make them, so as to prevent the nuisance you have spoken of?—Yes.

4812. Would that be considered a great hardship?—I think not. The case would apply to ourselves; we should have to do it at Elland.

4813. The cost would not fall upon the man who worked the coal, it would come upon the owner of the colliery; it would be an expense contingent upon the working of that coal?—The rule would be rather difficult to apply now, because to a great extent in Lancashire and Yorkshire all the mines that come to the day are worked out; the mines now in work are all deep sunk.

4814. Anything that is done now must be done in some other way; the matter must be taken up where it stands?—Just so.

4815. (*Professor Way.*) Your opinion is that it is of great importance that this ochrey water should be kept out of the river, as it is one of the serious causes of pollution?—I suppose it is.

The witness withdrew.

Mr. Thomas Brooke (Huddersfield) examined.

4816. (*Chairman.*) You are a manufacturer?—Yes.

4817. Where is your mill situated?—At Armitage Bridge, in the township of South Crossland.

4818. What number of hands do you employ there?—About 540 or 550.

4819. What form of power do you use?—Steam and water combined. At times we have been able to run exclusively by water power, but we have ordinarily to use steam power as an auxiliary.

4820. What amount of power do you use in water and in steam?—I believe the water power has been indicated at about 140 horse, and the steam power at nearly about the same amount.

4821. What weight of coal do you burn per annum?—About 5,000 tons; fully 100 tons a week.

4822. Would that produce about 500 tons of ashes per annum?—Not less than 700 tons.

4823. What have you done with your ashes up to this time?—Some portion of them has been used upon the roads, but the great bulk has been thrown into the streams and has passed away with the flood water.

4824. Have you any reservoir room at your mills?—There is a long dam which forms a large reservoir.

4825. Is it a goit that leads the water in for power?—Yes.

4826. Do you sludge that out occasionally?—Not oftener than once in about five years.

4827. When it is sludged out where does the material go to?—Down the river.

4828. How long have your works been established?—From 40 to 50 years.

4829. I suppose they have been increased from time to time?—Yes; but they have been pretty large works from the first.

4830. Are there many mills situated above you?—Yes, a great many.

4831. Has the number been added to since your mill was established?—Yes, a very large proportion of them have been built since that time.

4832. In what condition is the water now as compared with what it was when your mill was first established?—I cannot remember that, but I have not the least doubt that it is very much worse.

4833. In what state is it now?—We have not used the river water for manufacturing purposes for perhaps 30 years.

4834. You have abandoned its use for that time?—Yes, we have got a good and independent supply of pure water.

4835. How do you obtain that?—We have two bore-holes, one about 73 yards deep, and another about 111 yards deep, from which we obtain a large supply of water; we have pumps working day and night. One bore raises about 175½ gallons per minute, and the other about 149. On Saturday afternoon we do not work; and I calculate, making an allowance for that, and also for occasional stoppages, that the pump will work six days of 20 hours every week. Besides that there is a pure stream that flows down some property of ours, and we have a reservoir into which a part of that is diverted, and another system of pumps which pump somewhere about 100 gallons a minute from it, and those pumps are working both day and night.

4836. You are exceptionally situated as to water?—Yes; we have a fair supply of pure water, and we use it for all manufacturing purposes. We use river water for condensing in the engines, and after that for feeding the boilers.

4837. Do you find that it answers for feeding the boilers?—Yes; we have not at present had any damage done to the boilers by the water.

4838. You find it is better for the boilers than spring water?—I fear we could not supply them with spring water. Our boilers are all made now of Lowmoor iron, but some years ago they were made partly of Lowmoor iron and partly of Staffordshire iron, and we found that the water affected the Staffordshire iron materially, and that the plates became very much honey-combed, whereas the Lowmoor plates at the same time stood the action of the water perfectly, and we have hardly any incrustation in the boilers from using the river water.

4839. Have you had any analysis made of the spring water?—We have, but I am sorry to say I have not been able to lay my hand upon it; it is remarkably soft water.

4840. Do the springs vary with the seasons?—Not in the least. We have not been aware of the slightest alteration during the whole time that that system of pumping has been in operation, except in the case of the supply pumped from the stream which I named; but with the bore-holes we have not had the least variation.

4841. Do you know how deep the pumps are placed from the surface in the bore-holes or wells?—No.

4842. Does the bore-hole commence at the surface?—I do not know, but I think one is a well of considerable depth, continued by a bore-hole.

4843. How far are the two bore-holes distant from each other?—I think 50 yards.

4844. Do they produce a similar quality of water?—Yes, very similar.

4845. So alike as to make you believe that they come from the same springs?—Yes; we fancy so, the water is remarkably soft, almost too soft for dyeing. The men say that they cannot keep it in the pans, because it boils so quickly, and before they get any wool in, it is almost all over the dye houses; it is a strong alkaline water, of wonderful power in scouring and cleansing wool.

4846. (*Professor Way.*) Is it more than simply not hard?—Yes, it is strongly alkaline. These pumps together pump up about 510,000 gallons in a day, and we use the whole of that for manufacturing purposes.

4847. You use that for washing and dyeing?—Yes. This bore-hole water we do not use for dyeing; we use it for scouring wool to the extent of about 250,000 gallons.

4848. What weight of wool will that quantity of water scour?—Nearly 2,000 lbs. of wool a day, not quite that quantity. The wool, after scouring, goes through three different baths; from the first bath in washing the scour out will be like that (*pointing to a bottle*), from the second it will be purer, and from the third the water will run out perfectly clean. Only a small portion of the 250,000 gallons will come out in that state (*pointing to the bottle*).

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4849. Is there anything that could be usefully extracted from water in that condition?—I am not aware, but I have seen some account of something having been extracted from it.

4850. In the shape of potash?—Yes.

4851. (*Chairman.*) Have you any considerable area of land attached to your works?—We have some land.

4852. Agricultural land?—Yes.

4853. Of what extent?—Of my own and the landlord's there are about 120 acres.

4854. You have probably heard some evidence as to irrigation by refuse waters from washing and dyeing?—Yes, I have.

4855. Has it ever occurred to you to try such an experiment on your own land?—No; on our own land we could not do it without pumping to a higher level.

4856. Suppose you could get double crops of hay from your land by irrigating it, would the profit not pay a considerable part of the cost of pumping, if not all?—Yes, it might.

4857. What is hay worth a ton in your valley?—We grow very good hay, and it sells at about from 5*l.* to 6*l.* a ton.

4858. Do you know what weight per acre you get off your land?—No; but on the meadow lands we have some very heavy crops, nearly two tons off the meadow land. Off the top land on the moor not so much.

4859. Would you be surprised to hear that that land might by irrigation be made to produce twice or three times that weight of crop?—No.

4860. You think you could find some method of utilizing the products from your works?—Yes.

4861. Are you aware that land under irrigation is producing from 40 to 50 tons of green crops per acre?—Yes, I have read that.

4862. And in a good many cases six or seven cuttings?—Yes.

4863. Of sweet and wholesome grass for agricultural purposes?—Yes. There are some fields between this and Halifax which are irrigated, and which show in a very striking manner the immense crops that can be raised from ground so treated.

4864. In the event of any law being enacted prohibiting you from turning waste dye water into the stream, you would not be placed quite in the same difficulties as many others would be with regard to utilizing it?—No.

4865. If irrigation by such refuse is proved to be profitable, you would be benefited rather than injured?—Yes.

4866. You can pump all the well water to considerable heights for a very small cost?—Yes, our own system proves that.

4867. In the great metropolitan waterworks they can pump about 90,000 gallons of water 100 feet high for a working cost of 1s., and a very large volume of water may be pumped 100 feet high at a very low working cost?—I believe so.

4868. What does your coal cost you?—We get it principally from the Barnsley district and Thornhill; it averages now, I think, nearly 8*s.* per ton.

4869. Is it a good quality of coal?—Yes, but we use some that is very much lower. I am averaging the cost of the gas coal and everything and it is from 6*s.* to 8*s.*

4870. Do you use slack?—Not much; we consider that it is best to have the better quality of coal.

4871. Are you at all inconvenienced by floods?—Not so much as we used to be.

4872. Have you carried out any improvements which have prevented the injurious effects of flooding?—No; The river Holme is better regulated now by the reservoirs at the top of the stream, which I think have prevented floods.

4873. Do you pay now for any water that comes down from the reservoirs?—Yes. I will, if you please, refer to the Holme Reservoirs Act, of 1853, in which is incorporated the usual Commissioners Clauses Acts. Below the Bilberry Reservoir the clause runs thus:—"Upon all occupiers of mills, factories, or "other works or premises, who shall hold, occupy, or "employ any fall of water situate below the site of "the reservoir and embankment by the said first "recited Act authorized to be made across the rivulet "or brook called Diglee, at or near Bilberry Mill, "and which mills and factories, or other works or "premises, shall be supplied with water from any "part of the said rivulet or brook called Diglee, "between the side of the said last-mentioned reservoir "and embankment and the point of junction of the "said last-mentioned rivulet or brook with the river "Holme, or which shall be supplied with water from "any part of the river Holme, situate between the "said rivulet or brook called Diglee and the point of "junction of the river Holme with the stream, ri-"vulet, or brook called Ribbleden, otherwise Rivleden "rivulet or brook, a rate or assessment not exceeding "in any one year for every foot of fall so held, "occupied, or employed, the sum of 33*s.* per foot, "and so in proportion for any less measure than a "foot.' That does not apply to us.

4874. A specified volume comes down?—No; there is no specification of that kind.

4875. If the occupiers are to pay 33*s.* per foot fall, I think you will find it says that there shall be a steady outflow of a certain quantity of water?—No. I believe there is no such stipulation in the Act.

4876. Then how is the discharge regulated?—There has been a committee appointed of some of the directors of the reservoir, and practically it amounts to this, that in each valley they have found out some mill which they have taken as a standard, and a fair supply to that mill is found to yield a fair supply to millowners below.

4877. (*Mr. Harrison.*) Where is the supply to the reservoir obtained?—The drainage area is 1,960 acres. The rainfall in that collecting area is much larger than it is in the other two collecting areas, although they are not very distant.

4878. Is your reservoir sufficiently large to intercept all that?—We cannot sometimes, because the flood waters come in so strongly, we cannot take it all.

4879. So that a large quantity passes away?—Yes, in heavy floods. We have no specified volume to send down. There is a heavy rainfall above that valley.

4880. What quantity do you draw out daily?—I am not prepared to say, but it varies very much. On the Ribbleden Brook, below the Holme Styes Reservoir, and right down to Holmfirth, our assessment for every foot of fall is 25*s.* per foot.

4881. We were told yesterday that 24*s.* was the maximum rate they were paying.—No; that is upon another system. I may add that these rates as specified would raise from the mills now occupied about 1,500*l.* a year, but that has been insufficient to meet the expenses of the Act. There is another clause which enables the directors to lay an additional rate, to be spread over the district, not exceeding 100*l.* a year. Practically, the rates are about 1/15th more than those rates. With regard to the Boshaw Whams Reservoir, the clause is, "Upon all occupiers of mills, "factories, or other works or premises who shall hold, "occupy, or employ any fall of water, situate below "the site of the reservoir and embankment by the "said recited Act authorized to be made across the "stream called Upper House Dyke, at Boshaw "Whams," &c. "there shall be a rate or assessment, "not exceeding in any one year, for every foot of fall "so held, occupied, or employed, the sum of 18*s.* per "foot." Then there is a fourth rateable clause in these terms:—"Upon all occupiers of mills, factories, "or other works or premises who shall hold, occupy, "or employ any fall of water, situate below the "sites of the aforesaid several reservoirs and em-"bankments at or near Bilberry Mill aforesaid, "and near to the above Holme Styes Mill aforesaid, "which mills, factories, or other works or premises "shall be supplied with water from any part of the

" river Holme, situate between the points of junction " and the said river Holme with the stream, rivulet, " or brook called Ribbleden, otherwise Riveden " rivulet or brook," &c., "a rate or assessment not " exceeding, in any one year, for every foot of fall so " held, occupied, or employed, the sum of 45*s.* per " foot, and so in proportion for any less measure than " a foot." Then lower down still the rate is 60*s.* per foot; with the exception of two mills which are specified, that is what we pay. Our mill is situated on that part of the stream.

4882. Are you paying 60*s.* per foot fall?—Our rate amounts to 75*l.*, and the additional amount raises it to a little over 80*l.*

4883. How many feet of fall have you?—I think about 25. Then lower down, after it joins the Colne, the rates are reduced considerably as the system is different, and the riparian manufacturers do not get so large a proportion of water from this system of reservoirs.

4884. (*Chairman.*) What arrangements have you made at your mills for privy accommodation?—They are all open privies and ashpits.

4885. Does the overflow pass into the river?—No. We use it for agricultural purposes.

4886. That is an arrangement of your own?—Yes.

4887. Have you seen the newly-invented earth closets?—No, I have not, but I have read of them.

4888. Do you collect all the urine at your works?—Yes; and we use it in scouring. This (*producing a sample*) is the refuse that Messrs. Teall leaves after extracting the soap and oil refuse; it is not turned directly into the stream; we have an amount of dry refuse produced in the mill, upon which they turn and filter this liquid refuse, and that makes the dry refuse more valuable as manure; of course the liquid must get into the stream, but not directly.

4889. You have stated that you use 250,000 gallons of water per day in scouring 2,000 lbs. of wool?—Yes, nearly that.

4890. What quantity of water do you use in the dyeing process?—We use a different supply of water; we turn out from 11,000 to 12,000 gallons of foul dye water, which I believe is really the nastiest stuff that we do turn out of our works; it passes into the stream in that quantity per day.

4891. Does that resemble the black water contained in this bottle (*pointing to the same*)?—Yes.

4892. What weight of wool does that quantity of water dye?—We scour about 2,000 lbs. of wool a day; it is all dyed either as wool or cloth before it leaves our premises. Ours is principally the fine trade, and we use a small proportion of mungoes. We make some of the low goods, and I believe we use about 90,000 lbs. of mungoes in weight in a whole year.

4893. In cleansing cloth, what quantity of water do you use?—I have not been able to calculate that, but we use the whole of the 500,000 gallons that we pump, and the remainer of it must go in the scouring and washing, and the finishing and other processes.

4894. How long have these bore-holes been in operation?—One has been at work between 30 and 40 years, and the other for perhaps 20 years.

4895. Has it ever occurred to you to attempt to increase the volume of water by putting down an additional bore-hole?—No; we have not tried that. I may add that in some land of mine near, there is a large number of springs which are running into the river, and the water from them is not collected. I believe therefore that we might collect a larger body of water by going to the necessary expense.

4896. What distance are those springs from your works?—They are not far off, within half a mile.

4897. At what elevation are they above you?—The water would run by gravitation to the lower part of the works.

4898. It might be collected by contouring the land with earthenware pipes?—Yes; we have had some such scheme under our consideration.

4899. (*Professor Way.*) The waters of the springs in this district are hard generally, are they not?—Yes, they are rather hard; part of that water I collect for my own domestic purposes, and it is good.

4900. The quantity of water you use in the different processes is very large?—Yes.

4901. Do you find it is expensive to pump?—Not very; though of course the power must cost something.

4902. Do you find it desirable to use those large quantities?—Yes.

4903. If you had to deal with that liquid afterwards for the purpose of purifying it, the quantity would add materially to the cost would it not?—I think, as far as I have been able to form any opinion, that what we should in that case have to treat would be 11,000 or 12,000 gallons, which is a manageable quantity.

4904. If you were obliged to purify the water and send it clear into the stream, do you think you should economise the consumption of water in the first instance by improved machinery?—Yes, we might try that, but our goods require to be sent out in a particularly pure state.

4905. Vats used in finishing goods to get them free from matter that can be washed out of them would not injure the stream in all probability?—The washing out processes after scouring are continued till the water runs away bright.

4906. A very little impure matter injures the cloth but does not much injure the water?—Yes.

4907. (*Mr. Harrison.*) Why should not the last water of the washings, which comes out comparatively clear, be pumped up again to be used in the first processes for which pure water is not necessary?—I have no doubt that that is possible, but as we have a constant supply of water we do not do that.

4908. It is perfectly clear that as you go on towards the last of the washing processes you get purer and purer water running out, which would be good enough to wash with at the beginning?—Yes, no doubt.

4909. You have no inducement to try that at present?—No.

4910. You might have a difficulty in managing it?—I imagine that it could be done. It was stated by some of the witnesses yesterday, that they believed all water from the scouring would be taken by some chemists. In our case they only take the thick suds; of course, the valuable part is the oil, whatever oil there is in it. We are large consumers of indigo.

4911. Is it not possible that they may be able to purify those liquids by a better system of management?—I think so.

4912. They take the cream of your liquid now, and then they get the grease out of that liquid?—Yes, that is just the process.

4913. (*Chairman.*) How long has the experiment been carried on of extracting the grease and oil?—I believe our works were one of the earliest at which it was established. I cannot say how many years ago.

4914. Is it unfair to ask you what you are paid for it?—Something very small indeed. I believe we have to provide steam for the purpose, and I doubt whether we put anything into our pockets by it.

4915. What weight of soap do you use in washing?—For washing and milling together we use about a ton of curd soap per month, and besides that we use nearly the same weight, although not quite, of soft soap.

4916. You use about 24 tons of soap per annum of the two kinds?—Yes, or about 20 tons.

4917. What value does that quantity represent?—Curd soap is now about from 37*l.* to 38*l.* per ton; the price of the other I do not know exactly, but I think 69*s.* per pack of 240 pounds.

4918. What amount of olive oil do you use?—About 60 tons of the best quality. We use a very good quality of oil, but the price varies a good deal.

4919. The value of the waste products will be, of course, in proportion to the cost of the material used, and the amount recovered?—Yes. I should imagine that the material we put in ought to be worth as much as could be got at any mill. We use about 60 tons of oil in a year, and that would cost about 3,000*l.*

4920. (*Professor Way.*) If you took the process

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into your own hands, would not the grease recovered by a proper method of dealing with it pay you for the expense of purifying all the liquids?—I do not know the value of grease, or what proportion is yielded after these operations, but I think it is very possible.

4921. (*Mr. Harrison.*) Have you ever known the grease that has been recovered used again in the process of cleansing the cloth?—I have not.

4922. (*Professor Way.*) Are you aware that the products are taken to Messrs. Teall's works, and that the oil and grease are distilled?—No, I am not. We generally import our oil.

4923. (*Chairman.*) It appears that the soap of the two kinds and the olive oil will represent something like 3,800*l.* per annum?—Quite that, I think.

4924. If you receive 40*l.* or 50*l.* per annum, that is a very small item as compared with the gross expenditure?—No doubt. For some time we were getting a very inadequate return for what was sent away.

4925. (*Mr. Crowther.*) I may be permitted, perhaps, to state that we use at least 4,000*l.* worth of material. I find that we use 7 cwt. or 8 cwt. of soap, and of oil we should use about 28 cwt. or 30 cwt. per week.

4926. How much does it cost you per cwt.?—About 59*l.* per ton.

4927. Do you receive a rental for your soap waste?—Yes.

4928. How much?—From 50*l.* to 60*l.* There is a large quantity of oil in the shoddy.

4929. That is carried away by the cloth?—No, it is waste, the oil is extracted from that. We make a ton per week of heavy refuse, and that is sold again for so much a ton. The parties extract considerable quantities of oil from that.

4930. (*Professor Way.*) That is to say, all the oil is not dealt with in the way you have described.

(*The witness.*) No, a very considerable proportion goes away in the heavy waste.

4931. (*Chairman.*) Have any complaints been made as to your fouling the water?—Never.

4932. Have you made any complaints yourself?—No.

4933. Have you suffered from the ochrey water of which we have heard?—We do not use it for manufacturing purposes, therefore we have not suffered. I have noticed it very much indeed. I remember on one occasion in January last when for two or three days the river was perfectly yellow for miles.

4934. If you had used that water it would have been to your injury?—Yes; it was utterly impossible to use it. It would have destroyed our business for the time being, but it did not last long. I took up a large can-full of the water and kept it for some time. I live close to the water, and we do not experience any ill effects from it as a nuisance; occasionally after very dry weather, if there was a fall of rain, it was a little offensive, but never much so.

4935. It is not offensive as far as your experience goes so as to be injurious to health?—No. One portion of our district nearest the water is the healthiest part of it. There is one most remarkable case I may mention: During the last year the mortality has been considerably less than one half what it was in the two dry seasons that preceded. In our ecclesiastical district I mean.

4936. Do you mean that the mortality is increased by extremely dry weather, and reduced by wet weather?—Yes.

4937. That shows then that dilution of refuse matters, whatever they may be, is so far apparently beneficial?—Yes, I fully believe that. Some questions were put to a member of the Honley local board about their death rate. I have procured this return of the death rate (*handing in the same.*)

4938. Is there a local board in Honley?—Yes.

4939. What is the population?—The population in Honley in 1801 was 2,529, now it is about double.

4940. What is the population now?—It was very much reduced at the last census, but I imagine it is increasing now; it is nearly 5,000 now. In 1811 it was 2,918. In 1821, 3,501. In 1831, 4,523. In 1851 it was about 5,500, and it was reduced by nearly 1,000 in 1861.

4941. It is nearly 5,000 now?—Yes, or it was. At the last census there were upwards of 200 houses empty, and now there are not so many.

4942. Will not throwing ashes from the mills into the river by raising the bed ultimately injure very much properties below yours?—Yes, it must be so. I do not think the bed of the river has been so much altered with us as the evidence shows it has been down below; but holes in the river seem very much filled up in places, and where there are turns and curves in the course of the river there has been an accumulation of silt. Altogether I believe that the general bed of the river is slightly altered.

4943. There is a considerable fall where you are I believe?—Yes.

4944. The current is much more rapid than down below?—Yes.

4945. Any serious deposit of material would be where the stream is wider and more sluggish?—Yes.

4946. In the lower districts you can imagine that where the stream is wider and the fall less this accumulation may go on until the river is raised above the adjoining land, and large areas may be swamped?—Yes, I can quite imagine that.

4947. Are there any other facts which you wish to lay before the Commissioners?—I think nothing, excepting that I heard Mr. Crowther's evidence, and his experience seems very much to confirm my own.

4948. Would it be difficult for you to utilize or get rid of waste ashes?—At present they have been taken by a contractor, who is constructing a railway.

4949. Will the railway station be near your works?—Not very near.

4950. Do you anticipate that you might be put to some cost and inconvenience if you are not allowed to put them into the river?—I imagine that probably there will be some plan of utilizing them discovered.

4951. Have you hitherto used ashes for making mortar for building purposes?—No, we have not had any building going on for some time.

4952. Have you heard the evidence that has been given with regard to conservancy for the valley of the Aire and Calder?—I have.

4953. Have you at all turned your attention to that subject before or since this inquiry began?—I have thought it over since the inquiry began.

4954. Have you come to any conclusion as to what form of legislation would be most advisable?—It has occurred to me that probably some board elected from the area that is affected might be empowered to carry out any legislation, but I think it would require that they should be under some other control, either a Government inspector or a control of some kind.

4955. If a board elected by the persons who would have to find the money, and representing the different interests could sit in Huddersfield, having power to employ and pay a certain inspector or inspectors to prevent nuisances, or to carry out the law, and if the inspectors were appointed with the sanction of one of the Secretaries of State, or the Board of Trade, and held office independent of the local authorities, except in the case of flagrant misconduct; if, in short, there were inspectors who were protected in the performance of their duties, do you think that would answer?—Yes, if there were officers like the Poor Law inspectors.

4956. Have you found any difficulty arise from any undue interference on the part of the Poor Law authorities?—I do not think so.

4957. (*Mr. Harrison.*) The water appears to be supplied from these reservoirs under Act of Parliament. I suppose that Act was obtained at the instigation of the millowners in these valleys?—Yes; there was a former Act of Parliament obtained. The bursting of the Bilbury reservoir rendered it necessary that a new Act should be passed, and it was obtained jointly by the mortgagees under the old Act and the millowners on the stream.

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4958. Those using the waters below, I suppose, take care that the supply comes down regularly?—There is not generally so much interest shown in that as you might expect. Many of those who are really the most interested in the matter are on the board, and they give most active superintendence.

4959. You say that you have 25 feet of fall at your mills, what quantity of water do you get in the summer time?—I do not know. As to the ochrey water, there is a barrel culvert constructed under the embankment of the Bilbury reservoir to take away some of the springs which were supposed to have done the damage in the old bursting, and the water coming out of that culvert is very strongly impregnated with iron.

4960. As to irrigation, do you know with what liquid the land at Salter Hebble is irrigated?—I do not know.

4961. You do not think it would be well to put waste dye water into sewage water destined for land irrigation?—I think it would be very injurious.

4962. All that is matter of experiment?—Yes; I believe that in the refuse we do turn into the river there is three times as much alkali as acid.

4963. (*Professor Way.*) Is the soap an antidote to the dye, or is it the dilution from the water carrying the soap that prevents the dye from being injurious?—I am disposed to think it is the dilution.

4964. Consequently you cannot say that the dye water is injurious?—No.

4965. (*Mr. Harrison.*) Are there not large quarries in this neighbourhood?—Yes.

4966. If other means of getting rid of the ashes failed, would it not be practicable to take the ashes into those quarries?—Yes. I may say that we have quarries on our own land, but I am afraid that in time the ashes would rather fill them up, and block up the access to the stone. In some parts there are very extensive quarries.

4967. At what expense could you take the ashes to those quarries per ton?—I do not know; it is up a very steep hill.

4968. At Wakefield it was stated in evidence that they were obliged to wheel the ashes out of their yards into boats, carry them some distance, and then take them from the barges on to some spoil land, at an expense of about 1*s.* per ton; they are therefore put to that expense, to which many manufacturers here are not put. I suppose it would be no hardship if all manufacturers were put on the same footing?—No.

4969. Do not you think that the right form of legislation is that each manufacturer should be compelled to purify his own waste water, and not Government, or the district should execute works to be paid for out of rates to be levied?—I believe the whole district would be so benefited by purifying the water that it would not be a hardship to spread a rate over a great area for the purpose of paying the cost of inspection and the general machinery of the Act. I fully expect to pay myself for anything that may be required at my own premises. I think I have estimated the price of coal rather too high; I think it averages about 7*s.* a ton.

The witness withdrew.

Mr. JOHN BURGESS (Huddersfield) examined.

Mr. J. Burgess.

4970. (*Chairman.*) You are manager of the Huddersfield Gasworks?—I am.

4971. Where are they situated?—In Leeds Road, at the lower end of the town.

4972. About how many million cubic feet a year do you make of gas?—About 130,000,000 cubic feet a year.

4973. What weight of coal or other material do you use in making it?—15,000 tons of coals; common house coal and cannel coal.

4974. What weight of coke do you make?—About 9,700 tons.

4975. Do you find a ready sale for it?—Yes.

4976. About what quantity of tar comes from the distillation of that coal?—About 1,000 tons per annum.

4977. What volume of ammoniacal liquor is produced?—About the same weight.

4978. What do you purify with?—With lime; dry lime.

4979. Have you ever tried the iron process?—We have not.

4980. What do you do with the waste lime?—We sell it for agricultural purposes.

4981. Does it accumulate to any serious extent upon the premises at intervals?—Never.

4982. You get it regularly taken away?—Yes.

4983. What do you get per ton for the waste lime?—2*s.*

4984. Have you ever tried it for building purposes, ground up with ashes?—No; but I know several parties who have tried it and found that the best part of the lime is taken away; it is more granulated; it does not stick.

4985. If ground up with ashes it makes capital mortar for foundation purposes?—So I have heard.

4986. Is there any waste product of any kind passed into the adjoining stream from your works?—No.

4987. If your cess-tank wants renewing with water, what do you do with the waste water?—We never allow them to run over at all, we carry on without it.

4988. Is there any water or vapour condensed in the gas mains?—Yes; there is some water condensed.

4989. How many gallons a year would come away of condensed material in the mains?—About 40 gallons per week.

4990. What do you do with it?—That portion of it which is near the works we carry into the works, and put it into the ammoniacal water and sell it.

4991. Is any of it put into the sewers?—None.

4992. Then you say that you do not pollute the sewers or streams by any of the products from your gas making?—Yes.

4993. Do you attempt to consume your smoke in making the gas?—We do not burn any coals, therefore we make no smoke; we burn our own coke.

4994. If any person has said that you have polluted the streams with waste products, they have said that which is not the fact?—Yes; we do not turn anything into the streams at all.

4995. In fact you utilize everything that is used in making gas?—Yes.

4996. (*Professor Way.*) Is it not a fact that the water which is condensed in the mains is rather more valuable than some of the other products?—Yes; there is more ammonia in it.

4997. And a quantity of napthaline?—Yes; which is valuable.

4998. You are not likely to throw that away?—No. In the higher end of the town, in an out district, the man who has to pump the condensed water up takes it to a manure heap from 500 to 600 yards off; as a rule we preserve it.

4999. (*Chairman.*) What do you obtain for your gas tar a gallon?—We do not sell it so; we get nearly 1*l.* a ton for it; we sell it in a lump, and for the ammoniacal liquor we get about 8*s.* a ton.

5000. (*Professor Way.*) About a penny a gallon?—Yes.

5001. Do not you get more than that?—No, I think not; gas tar is not worth 1*l.* a ton now, but I have known several contracts let at Manchester at 30*s.* As to the refuse from our place, we do not put anything into the river in the shape of ashes, or anything of that kind; we do not pollute the river at all; we cart away the ashes.

5002. Do you sell them?—No; we have the liberty to put them in places where they wish to raise the land, and it costs us 1*s.* a load the year round.

5003. How many loads do you take away in a year?—700 or 800 loads in a year. I may say that for about some six months we have a very easy lead close to the works, and it costs us very little.

The witness withdrew.

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JOSEPH WRIGLEY, Esq., jun. (Huddersfield), examined.

5004. (*Chairman.*) You are a manufacturer?—Yes.

5005. With your father and brother?—Yes.

5006. Where are your works situated?—The principal works are in South Crosland.

5007. About what number of hands do you employ?—Between 200 and 300.

5008. Do you dye and wash?—Yes.

5009. What weight of coal per annum do you use?—Rather under 2,000 tons.

5010. Do you employ both water power and steam power?—Yes, we treat the steam as auxiliary to the water.

5011. What amount of water-wheel power have you?—We have two water-wheels, nominally of about 30-horse power each.

5012. How often do you work them in a year?—We always work them; they work more or less at all times.

5013. Are you troubled with floods?—We have not been much troubled recently.

5014. Were you troubled previously?—We had the Holmfirth flood, and one after that where the water stood in our premises still higher than at the time of the Holmfirth flood.

5015. Has the bed of the river risen perceptibly since you remember it?—Holes and deep places have been filled up, but the bed of the river does not appear to have risen perceptibly.

5016. Have you as good a deliver from the tail of your mills as you ever had?—We have not heard complaint of any kind.

5017. What have you done with your ashes hitherto?—We have principally thrown them into the river.

5018. Is it inconvenient to dispose of them otherwise?—The difficulty is that we should occupy land which is now valuable; we have no quarries near us.

5019. If you are compelled to keep them out of the river, must you make a spoil bank?—We should have to heap them up.

5020. And destroy good land?—Yes.

5021. Has there been any demand for ashes for road or railway purposes?—To a certain extent, but not to a great extent; the supply largely exceeds the demand.

5022. You have not been so fortunate as Mr. Brooke?—No.

5023. If any restriction as to casting ashes into running streams were put upon the general trade of Yorkshire, it would fall specially hard upon you?—Yes, it would.

5024. What becomes of the dye water?—That is now turned into the river.

5025. Where do you obtain water for washing and dyeing?—We have a bore pump, and also the water of a stream turned into a reservoir.

5026. A tributary stream?—Yes.

5027. You do not use the river water?—Except in dry weather, when the spring water is not sufficient; we then pump the river water at a time when it is coming by clear.

5028. On Saturday evening?—Yes, and very early n the morning it is clear frequently.

5029. You have reservoir room for that purpose?—Yes.

5030. Of what area?—It is not large; a third of an acre perhaps.

5031. Is it necessary to sludge the reservoir occasionally?—Very seldom; it has not been done for many years.

5032. If you did sludge it would be scoured into the river?—No, we should sludge it by hand, and wheel the contents out.

5033. Then you use the sludge as manure?—It has not been sludged for the last 10 years, and I cannot speak to that.

5034. What conveniences have your workpeople provided for them?—Common privies.

5035. And ash places?—Yes.

5036. Do you utilize the refuse for agricultural purposes?—Yes.

5037. Have you land of your own in the neighbourhood?—Yes, we have some little land.

5038. Do you sell the refuse from the privies or use it?—We use it.

5039. Have you made any calculation as to the quantity of dye water you use or pass away?—I have not made any calculations as to that point, but I may say that I have heard the evidence which has been given, and I should be inclined generally to concur in the figures which have been stated.

5040. Have you suffered from ochrey water coming down?—It is one of the worst and most hurtful pollutions that we can have; it would prevent us using the river water.

5041. Do you think that, if practicable, some means should be taken to compel owners or workers of coal to use all due precaution to prevent ochrey water finding its way into the river?—Yes; for however the river might be otherwise cleansed its water could not with confidence be used if at times it contained ochrey water.

5042. Did you hear Mr. Brooke give his evidence?—Yes.

5043. He suggested that the day-holes should be walled up?—Yes.

5044. Which would prevent oxidization?—Yes, but I do not like to give an opinion upon that subject, not knowing anything about it.

5045. If it will not involve more than a reasonable cost, I suppose you would say that parties ought to be compelled to prevent the nuisance?—I should. It is most necessary that this ochrey water should be prevented coming down into the river.

5046. Do you produce any of this greasy dye water (*pointing to a bottle*)?—Yes, we do.

5047. Do you recover any portion of the grease?—Yes; so much at least as is produced after washing and scouring the cloth.

5048. Is it utilized on your own premises or sent away?—The grease and oil are extracted on our own premises and then sent away.

5049. Extracted by you or by the lessee?—The lessee.

5050. How long has that process been carried on on the premises?—Not very long.

5051. So far as that oil and grease are extracted the pollution is lessened from your works?—Yes, there is less grease and oil turned out. A question has been raised as to the condition of the refuse water after it has had the grease and oil extracted from it. I have here a sample of it as it leaves our works; ours is a better sample than Mr. Brooke's. The question is how much acid the liquid contains; its appearance may depend somewhat upon the colour of the cloth that has been scoured.

5052. (*Professor Way.*) Is there any reason why this (*pointing to one of the samples*) should not be made better than it is?—I really cannot say; it has gone through the filter and that is the condition in which it came out. I believe there is a gentleman here who will explain the operation.

5053. (*Chairman.*) You know, I presume, that acid is used to precipitate the soap and the oil?—Yes.

5054. Do you think it might turn out that the material after treatment, containing acid, might be more injurious than material before treatment?—It might, but I do not say that it would.

5055. You think the experiment ought to be fairly worked out?—Yes.

5056. I suppose it would not be an improvement if extraction of the grease and oil tended to make the refuse water more injurious?—It would not.

5057. Have you formed any idea as to what sort of dilemma you would find yourself in if you were told not to turn refuse water into the stream?—At present we should not know what to do, but I may say that if science can devise some scheme, and show it to be

practicable, I believe that there is the utmost desire on the part of the manufacturers at once willingly to adopt it, but to be told before being shown we should feel to be a hardship.

5058. I suppose that you have heard the suggestions which have been made with regard to utilizing the water by irrigation?—I have.

5059. Have you any means for doing that upon your own premises?—We have not.

5060. Do you think that there would be any conveniences near to you so as to render it practicable?—I think that in our case it would be a very difficult matter.

5061. You would rather be shown some other mode of getting rid of the refuse water?—Much rather.

5062. If not more costly?—Quite so.

5063. Is water power increasing in value in your district?—I should say that as the price of coals increases the price of water power must also increase.

5064. Is the price of coal increasing?—It is.

5065. About what do you pay now?—I think with Mr. Brooke, about 7*s.* on the average.

5066. In your opinion, will not this new branch railway bring your coal at a lower rate?—It will not; there will be no station nearer to our own manufactory than we have now.

5067. The line does not go through a coal-field?—No.

5068. In the event of any legislation being contemplated for compelling purification of rivers what is your feeling as to what the area should be of such legislation. Should the legislation be for an area like this or for the whole of Yorkshire, or for the empire generally?—I think that it should be extended over the whole country, both England and Scotland.

5069. You think that if any restrictive measures are put upon trade they should be as general as the trade throughout the kingdom?—Yes, on account of the competition which there is between the different districts.

5070. With your knowledge of Yorkshire and of the great growth of trade in Yorkshire, what is your opinion as regards the effects upon trade of the pollution which now exists. Do you think that it is beneficial or injurious?—Certainly; the pollution of rivers I cannot say is beneficial, but I do not think that in many cases it is as prejudicial as is thought or as would at first sight appear, because most manufacturers have a supply of pure clean water which they first use and then turn in its polluted state into the river; very few manufacturers are dependent upon river water.

5071. They have to find some other means of getting water?—Yes.

5072. But we have had evidence over and over again of cases where the manufacturer is dependent upon the river water?—In some instances, certainly, that is the case, and there river pollution must be prejudicial.

5073. Is it within your own knowledge, or have you heard of any of the finer portions of the Yorkshire trade being driven away on account of the difficulty of producing fine colours?—No; I do not know that any trade has been driven away.

5074. I do not mean the whole, but any portion of such trade?—No; I should not say that any portion has been driven away. At the same time, perhaps, we should in fairness confess that the Scotch produce better colours than we do in this district.

5075. And they get better prices?—They get better prices, but then they belong to a different class of trade. While upon the question of competition, I would venture to suggest that any process which we were required to adopt should not be too costly because of the competition which we have with other countries. That competition is very close, and if we English manufacturers were at an extra expense in producing the various goods, we should feel the consequences in the market.

5076. You have had a copy of this Commission?—I have.

5077. Have you looked carefully at the wording of it?—I have, but it is some time ago; I do not exactly remember it. I do not undervalue the necessity of cleansing these rivers. My remark was that we are not all dependent upon them.

5078. (*Professor Way.*) Not in an equal degree?—Not in an equal degree. I would not undervalue the importance of cleansing these rivers, and anything that we could do, I think, ought to be done by all manufacturers.

5079. (*Chairman.*) You are speaking from a manufacturer's point of view?—I am.

5080. Are you aware that polluted rivers flow down from manufacturing districts into purely agricultural districts, and into ornamental grounds used for residential purposes, and that the pollution seriously injures such property, and, in some instances, actually prevents the use of the water for agricultural purposes—for watering cattle, or any purposes of that kind?—I have heard that.

5081. And that you also poison the water which has heretofore been supplied for drinking purposes in towns, such large towns as Leeds and Wakefield, and several other of the Yorkshire towns?—I have heard that.

5082. Do you think that it would be right and proper in the Government, whose duty it is to look after the interests of the whole community, to protect if practicable the sufferers from that form of pollution?—I quite think so.

5083. If you will look at the first clause of our Commission, you will see that it says, "We have "deemed it expedient for divers good causes and "considerations that a Commission should forthwith "issue for the purpose of inquiring how far the "present use of rivers or running waters in England for "the purpose of carrying off the sewage of towns and "populous places, and the refuse arising from indus-"trial processes and manufactures can be prevented "without risk to the public health and serious injury "to such processes, and manufacturers." It says "*serious* injury," that means, I imagine, injury which would be ruinous?—I am quite sure that not only the Commission but the way in which it has been carried out is most satisfactory to all the manufacturers; they have the utmost desire to do what can be done for the cleansing of these rivers.

5084. (*Professor Way.*) Besides that, I suppose that a clear river is a source of enjoyment to thousands of people?—Undoubtedly. I fear that the remark which I made rather left the impression that in my opinion river purification is a matter of very little moment. I am far from having that notion. What I intended to convey was that many of us manufacturers have an independent supply of pure water which we use and then turn into the river, and that we should not, even if the river was cleansed, always be dependent upon the river water.

5085. (*Mr. Harrison.*) But you are a great advocate for all being put upon the same footing?—Quite so.

5086. At present manufacturers in upper parts of the stream who have such an independent supply, if they send foul water into the river down to manufacturers below who have not such an independent supply, are doing what they can towards not putting those manufacturers below upon the same footing?—Probably those below may also have their independent supply of water.

5087. But many of them have not?—If they have not they have other compensations, they have not so far to cart their wool, their coal, and their manufactured goods as those in distant valleys.

5088. (*Chairman.*) With regard to any form of authority that may be instituted to prevent river pollution, do you think that you can see your way to any board which shall work for the benefit of the district?—If compulsory measures are to be taken, it appears to me that there should be an Act of Parliament binding upon all, and in order to carry out the pro-

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visions of that Act it would probably be necessary to have some local board of conservancy.

5089. You think that the board should be elected by the persons who would be subject to its operations?—Quite so.

5090. Just as in municipal matters the ratepayers who are to be subject to the governing body have the power of electing that body?—Quite so.

5091. And you think that there should be a constant appeal to the electors by the retirement annually of a certain portion of the board, and a re-election?—I should suggest some scheme of that kind.

5092. So that if the persons elected neglected to do their duty, you would have the power of choosing others at intervals stipulated by the Act?—Quite so, that is what I should suggest.

5093. Have you any further remarks to make?—The board might appoint an inspector to carry out the provisions of the Act.

5094. That would be a matter of detail?—Quite so.

5095. (*Professor Way.*) The Chairman asked you whether in any legislative measure against river pollution you would think it necessary to deal with the whole country, or whether the operation of the Act might be confined to a district, such as that of Yorkshire, or as the basin of the rivers Calder and Aire, upon which we are engaged at this time. Would there be any serious objection by the manufacturers of this district if the district were dealt with alone without reference to the rest of the kingdom?

5095*a*. (*Chairman.*) On the understanding that Parliament should carry the process forward as time admitted?—Making a sort of experiment of this district.

5096. For instance, last session Parliament passed an Act which appoints Conservators over the main valley of the Thames. There are clauses in that Act which are exceptional so far as the valley of the Thames goes. The towns in the valley of the Thames are in a certain time to be prevented from putting any sewage into the waters of the Thames. There is no similar restriction in Yorkshire or in other parts of England?—I speak with some diffidence upon the matter, but it strikes me that the manufacturers in this district would like all the manufacturing interests throughout the country to be treated in the same way and at the same time. I think that they would not take so cordially to any scheme or urge it on so much unless all manufacturing interests in the country were dealt with in the same way.

5097. (*Professor Way.*) You quite allow that at the present moment manufacturers of this district, as a whole, are at a disadvantage as compared, for instance, with Scotland with its pure water?—I do not think that if you cleansed the rivers it would make any difference, because our fancy colours may be dyed in dye-houses where they have just as pure water as the rivers would furnish if they were cleansed.

5098. I understood you to say just now that you did not produce equally good colours with the Scotch?—Just so, but I do not attribute that to the pollution of our river water.

5099. (*Chairman.*) And if the rivers are to be cleansed it must be from other motives than merely to give you an advantage in competition?—I should say so. I do not under-estimate the actual advantage which it would be to manufacturers, but I do not think that it would work a revolution in the trade.

5100. (*Professor Way.*) But we, I think, have had many instances where the water used by manufacturers was nothing but river water?—There are various cases of mills in the neighbourhood of towns where river purification would be of great importance. They would find the benefit of a cleansed river.

5101. Such places as Dewsbury, for instance?—Yes.

5102. If the expense of rendering a whole stream more or less pure was not great, would not the manufacturers on that stream to that extent be put in a position of advantage, as compared with any district which did not purify the water?—Yes.

5103. You may say "At Huddersfield we are "already provided for, and we do not care that Dews-"bury should have proper water;" but, looking to the whole of Yorkshire, it might be an advantage more than commensurate with the expense to clear the water?—Quite so. I think that it would be in every way to the advantage of manufacturers to unite and to aid in cleansing the waters.

5104. In what way would you suffer if the whole district were dealt with?—It might cost too much.

5105. It is a question of cost?—Yes, I am treating the matter exclusively in that way. Of course, as to the pleasure of a pure river and its appearance there cannot be two opinions.

5106. (*Chairman.*) Is there anything further which you would wish to add?—With reference to putting the solid matter into the river, that point may be ripe for legislation, but with reference to some compulsory method of cleansing dye water, I would venture to suggest that the time has hardly come for legislation. Supposing that science should devise some scheme for cleansing the dye waters, still it would be imprudent immediately to enforce its adoption. Before making its adoption compulsory I would allow time for it to become generally known and to be generally acknowledged to be feasible, in order that you might have the good will of those compelled to adopt it.

5107. (*Professor Way.*) One of the witnesses in this room stated that if purification of some kind were made compulsory methods would soon be found to accomplish it?—In that I do not agree.

5108. You of course know that in any such act of the Legislature, time is given. In the case of the Thames the time allowed varies from one to three years?—What I mean is, that supposing that science should devise some scheme, and that immediately or very shortly afterwards an Act of Parliament should be passed, enacting that in a certain time it should be compulsory upon every one, a great many people would then hear of it for the first time, and would hear that in such a time they would be bound to use it without knowing its working and its feasibility.

5109. (*Chairman.*) You would like example to prevail before you made the rule compulsory?—Exactly so.

5110. (*Mr. Harrison.*) If Parliament made it compulsory on the part of manufacturers to keep these different sources of pollution out of the rivers, it would be necessary to appoint inspectors to examine the rivers and to report. Do you think that there is sufficient confidence in the magistrates of the county to let them be the board to appoint such inspectors and to have control of the rivers of the county?—I apprehend that an Act of Parliament would state what might or might not be done. The board of management would be compelled to carry out the provisions of that Act; their inspector would be an officer to carry out their orders, and to see that the provisions of the Act were complied with. Prosecutions under that Act might advantageously be made before the magistrates in petty sessions.

5111. Of course they would be so made under any circumstances, but do you think that the duty might with confidence be placed in the hands of the magistrates of appointing inspectors and of exercising control over the rivers?—Am I to understand you to suggest that the magistrates should be the local board of the district?

5112. No; I mean that there should be no local board but that the magistrates should take their place. Any local board would have interests which would rather favour the pollution than otherwise.—I think that it is very essential to get the cordial assent and concurrence of all manufacturers in this matter, and I think that that would be best secured by allowing them to elect a board of conservancy rather than

vesting the conservancy in the magistracy of the county.

5113. (*Chairman.*) Have you anything further to add?—I beg to hand in an analysis of the bore water.

The witness withdrew.

Mr. Benjamin Seed (Slaithwaite) examined.

5114. (*Chairman.*) What business do you carry on?—I am an oil and grease extractor.

5115. Where do you carry on your operations?—At Huddersfield and Milnes Bridge and in the district.

5116. What weight of material do you extract per annum in the shape of oil and grease?—Some of the places I have only taken lately.

5117. But you are carrying it on as a business?—Yes, I commenced here about three years ago, and I have been continually taking mills all the time.

5118. How many mills have you now?—Twenty.

5119. What weight of oil and grease per week do you make?—Perhaps four or five tons. I cannot say exactly.

5120. What is it worth; 18*l.* or 20*l.* a ton?—Yes.

5121. When the water comes away from the vats in which you extract the oil and grease, is this about the colour of it (*showing a sample to the witness*)?—Yes.

5122. And is there nothing in it which can be taken out with profit?—Not that I am aware of.

5123. You have not tried?—No.

5124. Are there many mills in the district which turn their wash water into the rivers without utilization?—Not so many now as there were; if there are any they are small ones which are not worth taking up.

5125. Have you tried the process of extracting indigo from the cake of grease?—No, but I know that it is done.

5126. Have you ever thought of trying it?—We have nothing in this neighbourhood which is worth while. I have had it tested.

5127. There is not sufficient indigo used?—No.

5128. Do you extract the grease from Mr. Crowther's soapsuds at Lockwood?—No.

5129. Who does that?—A person of the name of Sugden.

5130. Are there any other of the waste products which, in your opinion, may be turned to account?—I have only tried this one.

5131. Are you working under a patent or has the patent run out?—There is no patent for it.

5132. Any person is at liberty to use it?—Messrs. Teall have a patent.

5133. But your process is different from Messrs. Teall's?—Yes.

5134. In what does it differ?—They use steam.

5135. You cannot get so much extract by your cold process?—No.

5136. Then you would get more of the oil and grease if you could use steam?—Yes.

5137. What further proportion would you get by the use of steam; a third or a fourth more?—Perhaps about a third.

5138. Would it not pay you to obtain a royalty from Messrs. Teall to allow you to use steam?—We should have to arrange at each place for the manufacturer to supply steam, and the manufacturers do not like it.

5139. They do not like to be robbed of that amount of steam?—No, and therefore I have adopted the cold process.

5140. (*Professor Way.*) The matter which you extract does not separate so well, I suppose, by the cold process as it does by heat?—It does not, and it is a much quicker process by steam.

5141. (*Chairman.*) You do not know what proportion of oil and grease remains in this water (*showing a sample to the witness*)?—No.

5142. You know what proportion you get out of the liquid which you treat?—Yes, I know it pretty nearly; it varies according to the mill.

5143. If you had 1,000 gallons of wash water, how much sulphuric acid would you put to it?—It depends a good deal upon the parties who are scouring; some persons put as much material again in scouring as others, and then more acid would be required.

5144. In the strongest wash water what amount of acid would you use?—Perhaps 18 lbs. to 1,000 gallons.

5145. That would be to 10,000 lbs.?—Yes.

5146. How much does the acid cost you a ton?—From 4*l.* to 5*l.*

5147. (*Professor Way.*) That it really amounts to about 2 lbs. in a thousand?—Yes, as nearly as I can tell; it will vary.

5148. If anyone suggested to you a method by which the cold process would separate more quickly, and at the same time give a clearer liquid you would be very glad to adopt it?—Yes.

5149. Have you ever used anything besides sulphuric acid?—I have used a little alum.

5150. You must use that with an alkali and not with an acid?—Yes. Sometimes we try muriatic acid.

5151. However, if anything could be suggested so as to send this liquid in a clearer state into the river, and at the same time to increase your own product, you would be very glad to use it?—Yes.

The witness withdrew.

Mr. Charles Kershaw Hare (Huddersfield) examined.

5152. (*Chairman.*) You are manager of the Huddersfield Waterworks?—Yes.

5153. Have they been formed under a private Act?—Yes, under two Acts of Parliament.

5154. Where are your works situated?—At Longwood, about three miles from Huddersfield.

5155. What district do you supply?—The township of Huddersfield, and some parts out of the township.

5156. The works have been formed by a board of commissioners?—Yes.

5157. How did they raise the money?—On mortgage of the water rates.

5158. What amount of storage have you?—60,000,000 gallons.

5159. In your storage reservoir?—Yes.

5160. And then you have a compensation reservoir?—Yes, of about 45,000,000 gallons.

5161. And that compensation reservoir is worked exclusively for the millowners?—Yes.

5162. Not for supply purposes?—No.

5163. What is the area of your gathering ground?—The whole area is about 1,000 acres; that is for the whole of the reservoirs; for the compensation reservoirs and our own.

5164. It is not more than 1,000 acres?—No.

5165. Do you know what volume a day you give out of your compensation reservoirs?—The millowners use the water as they like; we have a gathering ground of about 500 acres.

5166. What volume a day can you afford to send out of your supply reservoir?—400,000 gallons, excepting in a very extreme drought.

5167. Last year how did you get on?—Last year it would be about 250,000 gallons per day, taking the average of the whole year.

5168. Did your reservoir run dry last year or the year before?—Not last year, but the year before it did.

5169. It literally ran out?—Yes.

5170. Have you had any scheme for supplementing the supply?—Yes; not in that district but in the Meltham district.

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5171. Do you sell any of your water for trade purposes in Huddersfield?—A small portion. We use one or two meters, but the quantity so sold is very small indeed.

5172. What do you get per 1,000 gallons?—The scale is 1*s.* where a party requires 100,000 gallons per quarter, and for lesser quantities the maximum is 1*s.* 6*d.*

5173. What is your rate for domestic consumption?—There is a scale of charge.

5174. Do you know what the rainfall is in Huddersfield?—About 32 inches per annum on an average of 12 years.

5175. It is sometimes less and sometimes more. Do you know what is the lowest?—24·39 inches is the lowest rainfall which we ever had.

5176. What has been the heaviest?—43·83 inches.

5177. Then your minimum to your maximum is about as one to two?—Yes.

5178. During the dry years, what supply could you give per day to Huddersfield?—I will read to you the supply as it was delivered in 1865, which was the worst year for our supply. From January to February, 24 hours; March and April, 12 hours; May, 9 hours; June, 7 hours; July and August, 6 hours; from the 1st of September to the 19th of October, 5 hours.

5179. That was in the 24?—Yes. It then increased up to 24 hours for November and December.

5180. During those slack periods was there any portion of the district situated on the higher parts, which could not get a supply at all places?—I believe that it has been stated that the reason of lack of supply was that a main at a very low part of the town had been laid of an insufficient bore, and that the lead pipe had got entirely stopped up; the stoppage was not general but only just a local occurrence which we could not help. All the rest of the town had the water according to these hours.

5181. (*Mr. Harrison.*) To what source were the poor obliged to have recourse during the stoppage of the water?—Our neighbours had a very short distance to go for it, and of course they fetched it from there.

5182. What is that book from which you are quoting?—It is the evidence given before the House of Commons and the House of Lords.

5183. Can we have a copy of it?—You can have this book; I brought it on purpose.

5184. It contains the principal evidence which you could bring to bear before the House of Commons?—Yes; it contains Mr. Hawksley's evidence, and the whole of the evidence upon the late Bill, both as regards our present works and our intended works.

5185-6. That would give us a thorough insight into every question connected with the water supply of Huddersfield?—Yes, everything.

5187. (*Chairman.*) Are you going on with that Bill in the next Session of Parliament?—No.

5188. Was there much opposition on behalf of the millowners to your scheme of last session?—I should say not. There was only the opposition which there generally is to all schemes which propose to take water from a millowner.

5189. If your works had been carried out do you think that you would have had a ready sale, for manufacturing purposes, of the surplus water which you might have had?—Yes, there is no doubt about it.

5190. Did you contemplate supplying intervening townships, such as Lockwood, and Newsome, and other districts?—Yes, the whole line which our pipes came through, South Crosland, Netherton, and so on.

5191. Would your line of main have run in such a district as would have enabled you to give a supply to Mr. Thomas Brooke and Mr. Wrigley if they had wished it?—Yes.

5192. Did they oppose you or assist you?—I think that they were neutral.

(*Mr. Brooke.*) We opposed.

(*Mr. Hare.*) You mean you opposed together with the whole of the millowners, not personally

(*Mr. Brooke.*) Just so.

5193. (*Chairman to Mr. Hare.*) Do you or do you not consider that it will be necessary to extend your works for the domestic supply of Huddersfield, apart from manufactures?—Yes, we really require it for Huddersfield.

5194. The town is growing and your works are limited?—Yes.

5195. What do you call your reservoir?—Royle's head reservoir; it is above Longwood.

5196. (*Mr. Harrison.*) It is to the left of the town of Huddersfield?—Yes.

5197. (*Professor Way.*) In your opinion is the water of the same nature as that of the Holmfirth reservoir and the Standedge reservoir?—Yes, it is off the same mountain district.

5198. Does it attack lead?—Not much; there is a little coating at the first passing through, but that becomes quite hard and the water never affects it afterwards.

5199. Is it not soft water?—Yes.

5200. Do you not know that it is said that soft water generally attacks lead?—Yes, but we do not find it to be so. I do not think that it does so in all cases.

5201. (*Chairman.*) Your commissioners are merely trustees, they are not a paid commissioners?—They are not.

5202. They are acting simply as commissioners for the benefit of the town?—Yes.

5203. And they are a separate body from the town commissioners?—Yes.

5204. Has there been any talk of amalgamating the two bodies?—In some circles there has, but I do not think that it is general. I do not think that the inhabitants would like it to be so. I believe that the inhabitants are perfectly satisfied with the waterworks commissioners, and with their actions, and that they would not like the existing system to be disturbed.

5205. Are some members of the waterworks commission also members of the body of town commissioners?—Yes, three, I think.

5206. Therefore it might happen that the water commission might be exclusively composed of members of the town commission?—Yes.

5207. Have you, from the want of storage, a large quantity of water running to waste yearly?—There is some.

5208. Has it been given in evidence as something like 50,000,000 gallons a year?—20,000,000 gallons.

5209. 20,000,000 gallons, I suppose, would not go very far in Huddersfield?—No.

5210. It would be about 40 weeks supply?—Yes.

5211. Is there any convenience for making a reservoir for storing those 20,000,000 gallons?—Yes, but Sir John Ramsden opposed it; he withdrew his opposition when we withdrew the making of the reservoir to hold that water.

5212. Then you are tied up by these restrictions?—Yes.

5213. Has inconvenience arisen from the divided authority, the waterworks commissioners being one body and the improvement commissioners another?—Only where neglect has occurred, and that might have occurred if both bodies had been together.

5214. Do you know that when streets have been repaired and put into proper order and new streets have been constructed by the improvement commissioners, they have shortly afterwards been taken up by the waterworks commissioners?—Yes, that has been the case I know, from the neglect of the town surveyor for the time being, to give notice of the streets being about to be repaired. In all cases where that notice has been given the water-pipes have been laid down previously to the streets being formed.

The witness withdrew.

Mr. Uriah Tinker (Holmfirth) examined.

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5215. (*Chairman.*) You own certain beds of minerals ?—I do.

5216. They are situated in the upper branches of the New Mill Valley ?—Yes.

5217. Have the coals been worked out there or not ?—No. There is one abandoned mine.

5218. Are you working coals there now ?—I am.

5219. Are you working them yourself or have you leased them ?—I am working part and have leased part.

5220. Have you occasion to pump any water, or does it come out at day-holes ?—We do not pump any.

5221. It comes out at day-holes ?—Yes.

5222. In working the minerals does ochrey water occasionally come out of those workings ?—My workings do not discharge any ochrey water, for this reason : The water from the upper bed flows into the lower seam and mixes with the soft bed water, and consequently it is so diluted that it is not of an ochrey nature.

5223. What is the name of the soft seam of coal ?—It is called the lower seam. The lower seam has soft water, and the upper seam has hard water.

5224. Did you tap any old workings full of ochrey water ?—Not in my time, but I understand that, in my brother's time, there was a deposit in the water.

5225. How long is that ago ?—10 or 12 years ago.

5226. Is that the period which was complained of ?—I should think that it would be.

5227. That is to say, when a very large amount of ochrey water was sent down the stream ?—I fancy that there have been two or three such cases, but I do not remember at what times.

5228. Have serious complaints been made to you during the last three or four years of your discharging ochrey water down the stream ?—None whatever.

5229. Do you think that to any extent you could prevent ochrey water coming out of the mines ?—I do not see how it is possible to prevent it. However, as I have said, from our mines the water is not discharged ochrey, because it is mixed with the soft water, which is in a larger proportion ; and, in addition to that, a large proportion of rain water, in wet seasons, finds its way into the workings and dilutes it still further, so that it is comparatively soft when it is discharged at the surface.

5230. What weight of coal do you get per month ?—I cannot say.

5231. A thousand tons a month ?—Yes, perhaps more.

5232. How long will those mines last ?—A great number of years I should say.

5233. Then the working will be continued until the mines are exhausted ?—Exactly so. The principal supply in that locality of hard water, ochrey water, is from an abandoned mine—in fact, that is the source of the stream. The mine has been abandoned for some years.

5234. Do you think that it would be possible to wall up the day-holes and to work that water in the mines ?—Yes, it is quite possible, but the question is whether a greater evil would not be created by doing so.

5235. In what way ?—I should imagine that the water would find its way to the surface. I do not apprehend that there is much injury from simply the water, but the evil is from the sediment being disturbed ; the danger, therefore, is from stirring up the water. At the time to which you refer it was the disturbing of the deposit which caused the injury ; it was not simply the water.

5236. Did you hear the evidence of Mr. E. Brooke, who said that if the air could be prevented from passing into the mine it would prevent the oxydation of the ochrey water and diminish to a great extent the amount of ochre brought out by the water ?—I did not hear his evidence ; I was not present.

5237. He suggested that if the abandoned day-holes were blocked up effectually, so that air was prevented from finding its way into the old workings, and the water prevented from coming out at those points the mischief would be removed ?—It might be to a certain extent, but if that was done I have no doubt that there would be complaints on the part of the millowners, because the water to which I am alluding, and to which you are referring, forms so large a proportion of the stream for the mills, that any such scheme as that which you mention would diminish their water power.

5238. You think that they would rather have the water as it is for power than have it diminished in quantity so as to lessen the ochre ?—Exactly so.

5239. Do you not think that if the old day-holes were blocked up that water would find its way through fissures of the rock in a natural manner, without bringing the mass of ochre it brings now ?—The water might so filter itself and purify itself to a certain extent by running through other strata.

5240. It would purify itself more in that manner than if left to run through the open day-hole ?—Yes.

5241. (*Professor Way.*) You could not block back the water altogether and prevent its being worked ?—Not at all.

5242. (*Chairman.*) If this ochrey water gets into a shallow pond or tank, will it deposit ochre ?—No doubt.

5243. Have you ever seen that done ?—Yes, very frequently.

5244. Is the ochre which is so deposited of any value ?—I was not aware that any attempt had been made to find a value for it, except that just before I came here Mr. Brooke informed me that he sold it—blocked up the openings and sold the deposit after a certain accumulation.

5245. If that deposit were dried, like so much clay, I suppose it would be taken away ?—It could be easily taken away.

5246. And smelted ?—I suppose so.

5247. It is used in different parts of the world ; it is used in Spain, and some of the finest iron is made of it ?—I was not aware of that.

5248. Do you know the manufacturers generally in this district ?—I know some of them.

5249. Are any of their works situated upon land of yours ?—I think not.

5250. Then you have no interest in them ?—I have not.

5251. And you have no wish to speak about them ?—No.

5252. Have you any interest in fishing in any part of the stream ?—No, I think that there are not many fish ; there are a few at the top of one stream.

5253. (*Mr. Harrison.*) Would it be any great hardship if owners of coal at old workings were called upon to form tanks, so as to deposit the ochre, and to render the streams pure for manufacturers ?—I do not see that it would be any serious injury where they had convenience for making a reservoir so as to deposit the ochre ; but in all situations you could not accomplish that.

5254. In some places they have put dams across the drift itself for collection of the ochre; would there be any difficulty in doing that ?—By doing so you would block up the level. Many of the colleries in our district are worked by means of a water level, and if you dam up the level which may come out in the main stream of course you have no opportunity of filtering the water so as to purify it.

5255. (*Chairman.*) Land is not of much value in the neighbourhood of the coal mines ?—Of course it is not ; I should say that in most instances it might be accomplished.

5256. (*Professor Way.*) Is it not in the shale that this ochre comes ?—Yes, it is from the hard bed of coal and the shale.

5257. Is it from the oxydation of iron pyrites with

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sulphate of iron in it; do you see little shining particles in it, shining sometimes like gold?—Yes.

5258. That is the source of it?—Yes.

5259. Therefore, if you could keep the air from it it is perfectly clear that you would prevent formation of ochrey water?—Yes.

The witness withdrew.

(*Mr. T. Brooke.*) I said something about the Holme reservoir; since then I have obtained the rainfall from Mr. Bateman's pamphlet, at Bilberry, and I see that the mean rainfall of five years was 51·3 inches, and at the Holme Styes 47·5 inches.

Mr. I. Robson.

Mr. Isaac Robson (Mold Green) examined.

5260. (*Chairman.*) You are a dyer?—Yes.

5261. Where are your works situated?—At Dalton and at Aspley. Aspley is just at the bottom of the town. Dalton is about a mile out, near the Wakefield Road.

5262. Are your works situated upon any stream or river?—My works at Aspley are upon the river Colne, not strictly the river but on what is called the Cut which forms a stream to run through what are called the Shorefoot mills.

5263. What number of hands do you employ in these dyeworks?—I think about 55 in both together.

5264. What material do you dye?—Cotton yarn and woollen yarn chiefly.

5265. Where do you obtain the water for dyeing purposes?—For the cotton yarn we gather it ourselves; we have two reservoirs collected from the country round, and in addition to that we have a bore-hole. For the woollen yarn, we get water from the canal.

5266. In neither case are you dependent upon the river?—Just so.

5267. Is it the broad or the narrow canal from which you obtain water?—The narrow canal.

5268. Do you use coal upon your premises?—Yes.

5269. For what purposes; for steam power?—For producing steam and steam power.

5270. What do you do with the ashes?—They are generally carried on to the road; there is a considerable demand for ashes for repairing roads and things of that sort.

5271. Do you put any of them into the river?—No.

5272. Do you use soap and oil for washing and scouring?—Yes, for scouring.

5273. What becomes of the refuse water from the soap?—It goes away with the dye water.

5274. Into the stream?—Yes.

5275. What colour is it; is it the colour of the water in any of these bottles?—It is various, according to the material scoured; sometimes it is nearly black.

5276. Is there not sufficient soap or oil in your refuse water to make it worth while to take it out?—We have tried the experiment ourselves and we have not found it answer; we have not found it pay the expense and trouble; it might be from the want of proper apparatus, but we had not convenience for it.

5277. In the experiment did you purify the water to any extent?—No, it was merely run into a tank and allowed to settle, and then the effluent water was allowed to pass away, and we used the sediment for manure.

5278. Did you use anything to precipitate the grease; any acid?—No.

5279. Do you know that in precipitating the grease in the case of this sample (*referring to a sample previously produced*) an acid is used?—Yes.

5280. And that this water was highly charged before it was treated?—Yes, I daresay that it might be possible.

5281. Was the sediment which you obtained from your tank beneficial for manure—Yes, I think that it was decidedly beneficial.

5282. Did you ever try the dye water, untreated, for the purpose of irrigation?—We never tried it ourselves. I have seen it tried.

5283. With what effect?—It had a very bad effect on grass land.

5284. It killed the grass?—Yes.

5285. Do you think that it was too strong?—I am unable to say, because it was on a very small scale, and it was tried not by way of experiment but accidentally.

5286. Accidentally by the bursting or overflowing of a dye vat on to grass land?—Yes. We have been in fact complained of for killing the grass.

5287. If you put urine on to grass I have no doubt that it would do the same?—I have no doubt of it.

5288. Do you use urine in dyeing?—Yes.

5289. Do you use pigs' dung?—No, that belongs to cloth manufacture.

5290. Do you use any dyewoods?—Yes.

5291. What do you do with the chips?—We burn almost the whole of them.

5292. Is any compulsion used to make you burn them?—No; it is our easiest way of getting rid of them.

5293. Could you throw them into the river if you liked?—It would be expensive, because we are situated on a hill 150 or 200 feet above the river, and the distance is considerable; we are about a mile from the river, and therefore it would be expensive to send them down to the river.

5294. How many gallons of water a day do you use in the dyeing and scouring processes?—It is very difficult to say exactly. At Dalton I think that we use something like from 24,000 to 30,000 gallons a day; it depends upon the amount of work which we have. At Aspley, where the water is rather more abundant, we probably use more.

5295. Could you carry on your processes by the river water alone?—No.

5296. If you had not these private sources of water supply you could not carry on your trade?—No.

5297. How long have you carried on business there—Fourteen or 15 years.

5298. Do you remember the river ever to have been in such a condition that it would have enabled you to dye with the water?—Immediately after a heavy flood and during wet weather I have no doubt that it would have answered the purpose.

5299. Do you know the weight of wool which you dye or treat?—It varies exceedingly, because we do not dye for ourselves; we dye for hire, for the trade.

5300. Do you know the general condition of the rivers of Yorkshire as regards pollution?—I know that in these manufacturing districts they are very much polluted.

5301. Do you think that that pollution tends to injure the manufacturing trade?—I suppose that it does. If the rivers could be kept pure, so that they could be used by the manufacturers, of course it would be a great benefit to the manufacturers.

5302. Have you any further remarks to make?—In looking at this matter it always appears to me to be beset with great difficulty. It seems that the very first thing which must be done is to find some means of utilizing the refuse or you must stop the manufactures. If the process used for that purpose is very expensive of course you place manufacturers here at a very great disadvantage as compared with those on the continent, that is to be borne in mind. I would also suggest that experiments tried on a small scale are no accurate test of carrying the matter out in practice. Very often experiments on a small scale appear very well, but when carried out into practice they cannot be done effectively or economically.

5303. Do you know that sometimes the experiment in the laboratory is far less advantageous than upon a

great scale?—No doubt it is so sometimes, but I have seen a great many instances where the thing has appeared very nice in theory and very practicable when tried on a small scale, but when it has been attempted in practice, owing to the difficulty of securing the same nicety of detail on a large scale, it has been utterly impossible to carry it out.

5304. Do you not think that that has sometimes arisen from the excited imagination of the inventor who is desirous that a result should be attained, and he bends everything to attain it?—I have no doubt that that has some influence.

5305. Do you not think that the cool judgment of an independent person is more reliable than the judgment of a would-be inventor or speculator?—I have no doubt of it, but I think that the judgment of a mere experimenter, a mere chemist for instance, who tries his process on a small scale, would be very unsafe as a guide until the same experiment had been tried on a large scale by manufacturers.

5306. (*Mr. Harrison*). If in the course of our inquiry we find cases where an experiment is made on a large scale and is successful, that would be a good ground for asking for its application generally?—Yes.

5307. (*Professor Way.*) Are theoretical chemists always devoid of common sense?—I should be very sorry to say so.

5308. I will give a little illustration. If I find that by pouring this stuff on to this bit of filter paper the blue stuff separates very easily, am I not fairly entitled to say that it could be separated by ordinary filtration?—It is possible to be done, but then comes the question of expense.

5309. Do not most of our practical processes come from theoretical chemists?—Yes; we are very much indebted to them.

5310. Are not the aniline dyes the result of modern theoretical chemistry?—Yes. The great difficulty is to contend with acids, alkalis, and many soluble salts in varying proportions; so many of these are used in dyeing that it is extremely difficult to separate them so as to make the liquid useful afterwards.

The witness withdrew.

Mr. Charles Mills (Mold Green) examined.

Mr. C. Mills.

5311. (*Chairman.*) You are clerk to the local board of Mold Green?—Yes.

5312. And secretary to the Chamber of Commerce?—Yes. I have drawn up a short report bearing upon the Mold Green district. I shall be glad to read it, and I shall be happy to answer any questions arising out of it. (*The witness read the same.*)

REPORT.

Mr. Charles Mills, solicitor, Huddersfield, says, I am clerk to the Mold Green Local Board, which appointment I have held for upwards of two years. The Local Government Act, 1848, was applied to the district of Mold Green by an order bearing date the 30th November 1858. The district comprises an area of about 585 acres. The population is about 5,000. The present rateable value of the district is 11,885*l.* 4*s.* 6*d.* The rateable value in October 1859 was 8,930*l.* 14*s.* 7*d.*

At present there is no general system of sewerage in the district, but plans for that purpose are in course of preparation. The Penny Dyke which runs through Mold Green receives the principal portion of the sewage. It is a stream which rises on the hills near Almondbury, and is perfectly pure at Penny Spring wood, which is within the district, at that point it is called the Penny Spring beck. A little lower down it is joined by another clear stream called the Benholmley stream, and a little lower down these streams are augmented by the water from Sykes' Clough stream which runs from Almondbury. These three streams form the Penny dyke. Some 300 yards below Penny Spring wood, the Penny Spring beck, and Benholmley spring, flow into a reservoir belonging to Messrs. John Day & Sons, and called the "Top Reservoir." Above this reservoir however are the finishing works of Mr. John Marsden. The water used at these works is taken from the Benholmley stream, and after being used it is turned into a subsiding tank, the effluent water runs into a covered drain which joins the Penny dyke immediately below the Top reservoir, the sediment being used as a manure. The water, when turned into Mr. Marsden's tank, is impregnated with ammonia and soap. Mr. Marsden's works are supplied by two pipes, one 4 inches, and the other 2 inches in diameter, and these run on an average about five hours each day. A short distance below the Top reservoir are the dye and bleaching works of Messrs. Shaw, who are supplied by water from the Sykes' clough stream. Messrs. Shaw have a reservoir in which they store up the water from Sykes' clough stream, and in which there are fish. After the water has been used by them it is turned into the Penny dyke. Immediately below Messrs. Shaw's works are the dyehouse and finishing mill of Messrs. John Day & Sons. The water used by them is derived from the Top reservoir, and after it has been used it is turned into the Penny dyke. The quantity of water used at Messrs. Day's dyeworks is about 7,000 gallons per day. They do not turn any solids into the dyke.

Below Messrs. Day's are the finishing, spinning, and dyeworks of Mr. George Gelder who is supplied with water from Messrs. Tolson's reservoir. The water so obtained is pumped by Messrs. Tolson, and after being used at Mr. Gelder's works it is turned into the Penny dyke.

The Penny dyke also receives the drainage from Messrs. Isaac Robson & Sons, and Messrs. Salkeld's dyeworks, and also the sewage from about 370 houses. Messrs. Robson alone use for dyeing about 30,000 gallons per day. Altogether I estimate that about 50,000 gallons per day is turned into the Penny dyke from the mills and dyeworks at Mold Green and Dalton. The dyke runs into the river Colne at Bridge End, and is not covered in for about 150 yards. At this open part it is joined by the Hall beck, which is clear but not perfectly pure, as it receives the drainage from about 13 houses. During the summer months the smell arising from the dyke is very noxious.

There is in addition to the Penny dyke a sewer called the Storth's sewer into which about 120 houses are drained. This sewer also empties itself into the river Colne. There are also about 100 houses which drain into the river near King's Mill. There is also the Lees beck which runs from Kirkburton through Dalton, and empties itself into the river Colne opposite Mr. Edward Brooke's house in Leeds Road Huddersfield. This beck was some 30 years ago noted for trout. Now it is polluted by the refuse from the manufactories; amongst others, from those of Messrs. Tolson Brothers, and Messrs. Wild of Dalton. The sewage of about 80 houses also runs into this beck.

There are about 70 houses on Kilner bank (within the Mold Green district) not drained at all. Privies and not waterclosets are in general use within the district. No doubt waterclosets will in many cases be substituted when a proper supply of water has been obtained. Mold Green does not possess any waterworks, the only means of supply being from wells and private pumps. The want of water is severely felt in the summer months. The Local Board contemplated obtaining a supply of water for the district from the three springs to which I have referred, and with this view gaugings were taken for one year from February 1865 to 1866, from which it appeared that during the months of February, March, April, and May 1865, the average flow of water per minute was as follows:

Benholme spring $29\frac{98}{100}$ gallons.
Penny spring - $33\frac{53}{100}$ „
Sykes' clough - $18\frac{89}{100}$ „

During these months, therefore, the average quantity of water per day was 118,080 gallons. The gaugings for the other months have not yet been reduced into gallons.

The water from the springs was analysed in 1857, by Mr. Lindsey Blyth, of the General Board of Health, who reported that the total dissolved impurities in a gallon of it was nine grains; that there were 8·5 grains of saline matter, and 0·5 grains of organic matter; and that there was scarcely a trace of suspended impurity in it. The saline matter consisted of sulphate of lime and chloride of sodium. Mr. Blyth reported that the water was "wholesome and fit for domestic use," and, indeed, by far the best of the samples which had been taken from the pumps and springs in the district and submitted to him for analysis.

The scheme was not proceeded with in consequence of the introduction by the Huddersfield Waterworks Commissioners of a Bill in the last Session of Parliament for supplying Mold Green and other outlying districts with water, which

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Bill the Local Board approved, but it was thrown out by the Committee of the House.

One of the greatest nuisances within the district is the manure depôt belonging to the Huddersfield Improvement Commissioners, Mr. Joseph Thornton, the inspector of nuisances, stated in his evidence before this Commission, that this depôt was not complained of as a nuisance, but only as an eyesore. This, however, is not correct. The Local Board and inhabitants of Mold Green regard it as a very great nuisance, and are unanimous in thinking that it is improper that a depôt for the reception of the night soil from a large town like Huddersfield should be placed so near to a densely populated district like Mold Green. [Unfortunately, however, the depôt was established previously to the adoption of the Local Government Act, and the Board are, therefore, powerless to compel its removal so long as the Commissioners use the best practical means for abating the nuisance, or preventing, or counteracting the noxious effluvia arising from it.]

Mr. Read Holliday suggests to you that the sludge from the river should be analysed for the purpose of ascertaining what gases emanate from it.

As the shallowest part of the river is near to Mold Green the district must be especially affected by such gases, and the Board would, therefore, no doubt be glad that Mr. Holliday's suggestion should be followed. The district is supplied with gas, the money expended on the lamps and mains having been borrowed by the Board. With this exception no public works have been executed by the Board, but upwards of 1,500*l.* have been spent by it in levelling, paving, and sewering (at the expense of the owners of the adjoining property) highways not repairable by the public.

There being no separate census for the Mold Green district only an approximate estimate can be made of the number of its inhabitants, and the rate of mortality cannot, of course, be correctly ascertained. It is, however, as near as I have been able to ascertain, at the rate of 20 per 1,000.

5313. Have you noticed in the Lancashire papers that a petition was sent up a short time ago from certain inhabitants in a portion of Liverpool protesting against the large deposit of manure at a certain point in the borough of Liverpool, and that an inquiry took place by order of the Secretary of State?—No. If you tell me that such an application from Liverpool has been successful, I am sure that it will be a very good hint to the Mold Green Local Board.

5314. It has been successful, and therefore if you cannot deal with this manure heap by ordinary means, I think that by such a petition you can obtain an inquiry, and some action in the matter?—I am very glad of such a suggestion, because on account of the clauses in the Local Government Act, the board have not found themselves equal to deal with the question. I am informed that near that manure there have been a very great number of fever cases, and the inhabitants of course attribute them to the manure heaps.

5315. Then, as far as Mold Green is concerned, may we take it that the board would be willing to do its best to prevent river pollution?—I think that they would.

5316. If you are going to adopt waterclosets, might not that tend to pollution if the sewage is not to be utilized?—Of course that would depend upon the character of the sewerage works; at present the sewage passes into the river.

5317. You have heard the evidence given before this Commission?—Yes.

5318. Do you think it at all probable that pollution by sewage will be allowed to be continued?—I think it desirable that it should be put a stop to if it can be done at a reasonable cost to manufacturers.

The witness withdrew.

Mr. T. W. Clough.

Mr. Thomas William Clough (Huddersfield) examined.

5319. (*Chairman.*) You are a solicitor?—I am.

5320. And for many years you acted as clerk to the Huddersfield commissioners?—For 17 years after the Commission was first established.

5321. You have resigned that appointment, and now are a member of the commission?—I am.

5322. You have, I believe, during the period of your connexion with Huddersfield paid considerable attention to sanitary matters as connected with the town?—I have.

5323. And, I suppose, have been acquainted with the district for many years?—I have known the district and have resided in it for nearly 26 years.

5324. In what condition do you find the streams and rivers of this district?—I find them very bad indeed. I remember when I was a schoolboy paying a visit to Huddersfield, and one of my pleasures was to fish in the river.

5325. Did you catch anything?—I did not; at that time I was too young, but I think that you may catch fish now in the canal if you think proper.

5326. What was the condition of Huddersfield when you first knew it with regard to its sanitary arrangements?—There was no system of sewerage at all; there was only a superficial drainage, such as would be accomplished under the Highway Act.

5327. And the refuse went into the adjoining stream?—It did.

5328. What was was the condition of the lower class tenements and common lodging-houses?—The common lodging-houses at that time were in a very fearful state. I went once or twice with the captain of the watch under the old Lighting and Watching Act, and I found the lodging-houses crowded to excess, with no means of separating the sexes, and filthy and dirty in the extreme.

5329. Do you think that the other members of society knew in what state the lower stratum of society in England existed?—I believe that very few indeed could form any conception of it, unless they had taken the pains to visit and to see it for themselves.

5330. As you did?—As I did.

5331. Did you make midnight inspections?—I did.

5332. What was the result of those inspections?—They left a deep impression on my own mind that some effort should be made to improve the moral and sanitary condition of the town.

5333. And it resulted in some practical measures being adopted?—It resulted in applying for the Huddersfield Improvement Act.

5334. In that Improvement Act what clauses did you get with regard to that special evil?—We had power to register the lodging-houses, and to inspect them, and to see better order and cleanliness observed; but, notwithstanding the powers which we had in the Special Act of Parliament, we found ourselves utterly unable to deal with the question or to remedy the evil which we saw, until we got a model lodging-house of our own.

5335. Where is the model lodging-house?—The model lodging-house is nearly at the top of Chapel Hill.

5336. Have you any statistics as to the management and cost of that model lodging-house?—I have. The total cost of the lodging-house at the commencement was 5,094*l.* 13*s.* 1*d.*

5337. How did you raise that money?—It was raised by loans; two loans were taken up, one of 3,600*l.* and another of 1,546*l.*

5338. At what per-centage?— Five per cent.

5339. And there was a redemption fund?—Yes; we entered into a negotiation with the Atlas Assurance Company, and the conditions were that we should repay one-thirtieth part annually, and we have done so down to the present time, together with the interest upon the amount of principal for the time being remaining owing.

5340. What is the annual cost of the management of that establishment?—I have not separated all the detail of the cost, but I have a statement of the amount which is taken out of the town's rates for the purpose of maintaining the lodging-house.

5341. For supplementing the receipts?—Yes.

5342. There is an income from the lodgers?—A considerable income; I have a statement of that income year by year, which I will afterwards hand in. From November the 6th 1854, when the lodging-

house was opened, to the 30th of April 1855, the income was 83*l.* 3*s.* 7*d.*, and in the following year it was 296*l.* 3*s.* 0*d.* In the year ending April 1857 it was 299*l.* 18*s.* 4*d.*; in the year ending April 1858 it was 358*l.* 6*s.* 1*d.*; in the year ending April 1859 it was 332*l.* 10*s.* 9*d.*; in the year ending April 1860 it was 419*l.* 1*s.* 1*d.*; in the year ending April 1861 it was 539*l.* 12*s.* 5*d.*; in the year ending April 1862 it was 520*l.* 3*s.* 1*d.*; in the year ending April 1863 it was 544*l.* 3*s.* 10*d.*; in the year ending April 1864 it was 558*l.* 1*s.* 7*d.*; in the year ending April 1865 it was 496*l.* 9*s.* 10*d.*, and in the year ending April 1866 it was 518*l.* 2*s.* 8*d.*, making a total of 4,965*l.* 16*s.* 3*d.*

5343. (*Mr. Harrison.*) What was the occasion of the larger amounts during the latter years?—The lodging-house had got approved. What I have given are the receipts from lodgers.

5344. What were your expenses?—The payments in wages during the same time amount to 1,907*l.* 11*s.* 3*d.* The net income is 3,058*l.* 5*s.*

5345. (*Professor Way.*) That is not including rent or interest for outlay of capital?—No, but I have the interest on the outlay in a separate form. I find that from 1855 to 1860 there was paid for interest 1,436*l.* 6*s.* 11*d.*, and in the next period, from 1861 to 1866, 1,010*l.* 16*s.* 5*d.*, making the total amount paid for interest 2,447*l.* 3*s.* 4*d.* But in estimating what the establishment has been doing we ought not to place upon the establishment the full amount of interest here charged, because we are paying now for the purpose of liberating or reducing the interest at a future period; and in order to do the institution full justice I have considered that the capital which we have borrowed is to be repaid by annual instalments, and I have taken the interest upon the full sum borrowed for the meantime—that is to say, for 15 years. I then take the total of the interest which will be paid during all the 30 years. I then reckon that the establishment has been open 12 years, so that the establishment ought only to bear six-fifteenths of the full interest for the 30 years.

5346. (*Mr. Harrison.*) Charging the establishment with that sum, and the expenses which you are at, are the receipts from the lodgers sufficient at present to clear outgoings?—They very nearly clear them; they would clear them except for incidental expenses which are continually arising.

5347. So that in a few years Huddersfield will have the advantage of this establishment without any cost at all to the town?—It will. I have made a calculation separately for the period from 1860 to 1866. I find that the total amount drawn out of the improvement rates during those years was 1,520*l.*, and during the same period there was paid in wages 1,907*l.* 11*s.* 3*d.*, the total of the payments being 3,427*l.* 11*s.* 3*d.* The income from lodgers during the same time was 3,176*l.* 13*s.* 5*d.*, and the interest which we paid in excess was 471*l.* 4*s.* 10*d.*, which would make 3,647*l.* 18*s.* 3*d.*; and taking off the 3,427*l.* 11*s.* 3*d.*, it shows the net profits for the six years at 220*l.* 7*s.* 0*d.* But this is supposing there has been no outlay for improvements; it is, however, my opinion that the establishment will in a very short time be a profit rather than otherwise to the town of Huddersfield.

5348. How many persons can you accommodate?—In the Mechanics' Home 43 single men, at 4½*d.* each per night.

5349. You charge 3*d.* to some do you not?—In the male department for single men there is accommodation for 80 at 3*d.*

5350. And for how many women?—For 11, at 3*d.*

5351. For how many married persons is there accommodation?—For 12 married couples, at 6*d.*

5352. How many people have you had in the house of late?—I cannot give the numbers; they are represented in the income derived, which I have already supplied.

5353. (*Chairman.*) Looking at what Huddersfield was when you first knew it, and looking at the results to be attained by the establishment of this lodging-house, do you think that members of Parliament would be justified in asking of Parliament to allow the Chancellor of the Exchequer to advance money for the extension of that principle at the lowest rate of interest compatible with security to the State?—I think that it would be attended with great national benefit.

5354. You are aware that 1,850,000*l.* has been advanced to Lancashire at the low rate of 3½ per cent.?—Yes.

5355. If you had received your money at 3½ per cent. what advantages would it have given to you?—The establishment would have been a great success much earlier than it has been, and it would have led to the more general adoption of that system throughout the country.

5356. In its adoption do you think that you have tended to lessen the poor rates?—Considerably. We had evidence called before the surveying officers when the Improvement Act was passed, which showed that there had been paid out of rates for the town of Huddersfield nearly 500*l.* in one year for the relief of the sick poor in those over-crowded, ill-ventilated common lodging-houses.

5357. Do you think that it has lessened crime?—Considerably.

5358. Therefore it will lessen the police rates, and the rate for criminal prosecutions?—Certainly. There is a very good thing in connexion with the Labouring Classes Model Lodging House Act, and other Acts. The police can obtain a return of the character of the persons who frequent the lodging-houses, and in the vagrant office we have the advantage of one of the inspectors of police being at the head of that establishment.

5359. Do you give the inmates any facilities for cooking?—There is a good cooking apparatus and there is always hot water so that anyone may come in and cook anything in a moderate way, in a reasonable time; anything to be fried or anything of that sort.

5360. Can they buy coffee or tea at a cheap rate from a person in the house?—They used to do so. I do not know whether that is carried on at present or not.

5361. However, you are perfectly satisfied, from your own experience, that such establishments may be carried on with great advantage to the communities in which they are situated?—I think they may be carried on with very great advantage indeed.

5362. And with great advantage to the individuals who use them?—Particularly to them. I think that the pecuniary part of the question is but a trifling matter. I think that you need not be anything out of pocket by lending money out of the national funds at a low rate of interest, while the advantages morally and socially, as well in the prevention of crime as for sanitary purposes, will be very great indeed.

5363. (*Mr. Harrison.*) Besides the provision for cooking, you have, I believe, some baths in which the people may wash?—Yes, there are baths, I believe, for both sides of the establishment, and lavatories.

5364. Are those baths supplied with hot and cold water?—Yes.

5365. Is the cost of the bath included in the 3*d.* or the 4½*d.*?—It is.

5366. If any of the people appear especially dirty, do you require them to take a bath?—If they are very bad the inspector will not admit them, except on the condition of taking a bath.

5367. There are lavatories as well?—Yes, with a constant supply of water.

5368. With towels and soap supplied for them?—Yes.

5369. And waterclosets?—Yes.

5370. Which are kept in good order?—They are.

5371. In the mechanics department have you a sitting-room?—A large sitting-room.

5372. And a library attached?—Yes.

5373. Can the men have the books out?—On applying to the superintendent they can have any book.

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5374. Without payment?—Without payment. I think it right to say that many charitable individuals are kind enough to send periodicals and papers.

5375. (*Mr. Harrison.*) Is there not a certain area put apart for each individual in the sleeping apartments?—There is.

5376. What space is that?—The length of the day rooms both for the mechanics and for the male department is 25 yards 2 feet 3 inches; the height is 11 feet 7 inches. The width of the bed space is 4 feet 7 inches, the height of the partition is 6 feet 6 inches, and there are 30 beds in each floor.

5377. Each of these compartments is supplied with a bed and a wash-hand basin?—Yes; with a constant supply of water.

5378. What kind of people have you occasionally applying to you for a night's lodging?—Very often people will apply there who are too poor to pay the charge, and they are obliged to go to the vagrant office. Sometimes men of intemperate habits in a state of insobriety, not fit to be admitted, are obliged to be refused.

5379. That is one limit, let us know the other; what is the highest class of people whom you have occasionally applying for a night's lodging?—I have known professional men live and sleep there for weeks together.

5380. (*Chairman.*) Doctors?—Solicitors, I think, chiefly. I have known more than one.

5381. You wished a question to be put to the clerk of the waterworks company?—I wished to suggest through my question that it would be much better if the water supply was in the hands of the improvement commissioners, who have charge of the sanitary condition of the district.

5382. In your opinion the two boards should be amalgamated?—I think so.

5383. And you would have one set of commissioners?—I certainly think that it would be advisable. I should be glad to see many of the waterworks commissioners at the improvement board. It is not from any personal feeling that I make the suggestion.

5384. But it is merely on the ground of economy as regards the management?—Yes.

5385. Have you anything further to add?—In connexion with the institution, I think it right to mention that, so far as my knowledge extends, this is the only instance throughout England where the inhabitants have availed themselves of the provisions of the Labouring Classes Lodging-House Act, by establishing a lodging-house at the cost of the township.

5386. Other districts, if they are wise, will follow your example?—I think that it is very advantageous. If it is left to individual charity I think that it will only be partially adopted.

The witness withdrew.

Mr. W. Mellor.

Mr. WRIGHT MELLOR (Huddersfield) further examined.

5387. (*Chairman.*) In your examination-in-chief, you spoke as to the proper future local government for prevention of pollution of rivers?—I may perhaps have expressed myself not very clearly, but my notion was simply this, that if you have a governing body it ought to be a governing body elected from the district.

5388. An elected body?—An elected body. I should strongly object to the magistrates being the governing body in a case like that; and I think that you should have in addition an inspector appointed, say by the Government, such as is appointed under the Poor Law or Factory Act.

5389. Or that the appointment should be at least sanctioned by Government?—Yes.

5390. And the officer should be irremoveable, excepting for some misconduct?—Yes.

5391. Is there any further statement which you wish to make?—I saw this morning, by the very hasty glance which I had of the report of the evidence given yesterday, that I am made to say that I would have the inspector to be under the control of the Local Board. I do not think that that would answer at all; I think that the inspector ought to be an independent person, to do his duty irrespective of any local boards which might exist. If the matter were entirely under the control of the Local Board, and they were not disposed to do their duty, the consequence would be that the duty would be altogether neglected; and, therefore, I think that a person should be appointed who would be altogether independent of them.

5392. (*Mr. Harrison.*) Will you specify what you think should be the duties of the Local Board?—I think that the Local Board ought to have a general supervision over the district and to take cognizance of anything which might be reported to them by the inspector, and in this way I think that they would contribute very much to the efficiency of the plan.

5393. Would you not in that way make the inspector their servant?—No.

5394. What would be the use of his reporting to them unless to receive instructions to take action?—It is one of those important things which I think ought not to be entirely in the hands of an inspector.

5395. (*Professor Way.*) I suppose that the different members of the board would be a great assistance to each other, in the first instance, in carrying out such a measure, by meeting and conferring as to what could be done?—Certainly. It would be a difficult matter to carry out such a measure at all, but you might, I think, succeed if you could get the concurrence of the entire district and a Local Board established.

5396. You object to the county magistracy because they would not have the proper interest?—Certainly. There is another thing which I would just mention. I see that I am reported to have stated that we could not turn out good colours in this district. I did not state that, and I think that it would be a very unjust representation of things here if that statement went forth. I stated that we could not turn out very good colours from the river water, and I am fortified in that remark by saying that I had no doubt that in Scotland they would sustain very great injury to their manufactures if they allowed their rivers to be polluted.

5397. (*Mr. Harrison.*) Are you aware that Local Boards have now power, in a very great measure, to put a stop to the nuisance of smoke?—I believe so.

5398. Can you tell us whether they carry out those powers or not?—Not very stringently, I fear.

5399. Do you think that that is a good precedent for placing in the hands of any Local Board the power of preventing the pollution of rivers?—If they had an inspector over them the inspector might do his duty if they did not do theirs.

5400. You would place the inspector over the Local Board?—I would have both.

The witness withdrew.

Mr. T. W. Clough.

Mr. THOMAS WILLIAM CLOUGH (Huddersfield) further examined.

5401. (*Chairman.*) Do you wish to make any additional statement?—I should like to add to my statement a suggestion upon the subject which Mr. Mellor has been speaking of, namely, as to the authority which should put the Board into operation. I think that the authority should be vested in some local governing body, but in dealing with the question of pollution of rivers I think that gentlemen being owners or occupiers of factories ought not to vote at the Local Boards upon those subjects, and I think that it would

be right for Government to retain the power of sending an inspector to make a special inquiry into the particulars of each town or district on receiving a report from a certain number of ratepayers complaining of the neglect of duty on the part of the Local Board, so as to compel it, in case of necessity and on proper complaint, to do its duty, either for preventing smoke or for preventing pollution.

5402. You mean that in providing legislative measures you would not permit the polluters to govern themselves?—I would not.

The witness withdrew.

Mr. Joshua Hobson (Huddersfield) examined.

5403. (*Chairman.*) What are you?—A newspaper editor.

5404. How long have you been a resident in Huddersfield?—I am a native of Huddersfield. I have resided in it nearly all my life.

5405. Then you are conversant, in a general way, with the commerce and trade of the district?—Yes.

5406. I suppose that you are also acquainted with the condition of the streams and rivers?—Yes, both past and present.

5407. Have you formed any conclusion as to whether legislative measures are necessary for the prevention of the further pollution of the rivers?—Yes; that is an opinion which I have entertained for a long time, and I have looked forward with great interest to the proceedings which are now going on.

5408. Have you formed any idea in your own mind as to what kind of government would best carry out those measures?—As has been said by previous witnesses, it is a very difficult question. Mere local government would not realize the object, the parties are so deeply interested. The same question arises with regard to the nuisance of smoke. We find it also in the administration of local Acts, such as Improvement Acts.

5409. Then you think that there should be a due and proper admixture of central and local authority?—Yes; and that the local authority should have jurisdiction of a large area, such as the area delineated upon that map.

5410. And if possible a complete area?—Yes.

5411. Taking the area upon that map as in itself complete, you think that there should be a representative body to have control, but not an exclusive control over that area; that they should be subject to some central authority?—Yes. The practice alluded to by yourself with regard to the valley of the Thames is a case in point. The way in which Boards of Waywardens are appointed and act under the present Highway Act would give another hint how a board might be constituted by representatives from various districts within the area.

5412. We have now several Acts of Parliament in which preventive measures are insisted upon, such, for instance, as Lord Derby's Alkali Act?—Yes.

5413. And the Act for the regulation of labour in mines?—Yes; and the Factories Acts.

5414. Out of those Acts I suppose you think that a very able man might draw something which should be practical?—Yes.

5415. And which should be acceptable?—Yes; and which should be effectual as well.

5416. Have you anything further to add?—With regard to the model lodging-houses, I was concerned with Mr. Clough in procuring the Huddersfield Improvement Act, and for five years I was charged with the management under the Act. I would beg to hand in the report of the Surveying Officers, which will give the Commissioners the fullest information possible as to the wretched state at that time of the lodging-houses, and the then state of the town. There are also here two statements of account showing the cost of the lodging-house. (*The witness delivered in the same.*)

5417. Did you hear the remarks which I made to Mr. Clough with regard to getting money at a low rate of interest for such purposes as model lodging-houses?—Yes, and I heard them with very great pleasure. I am also aware that last session there was a bill before Parliament introduced by Mr. McCullagh Torrens, which was a step in the same direction. Also under the Labouring Classes Lodging Houses Act of 1851, there is full power for local boards to do all over the country, and in every place, what Alderman Waterlow and others are doing in London, that is to say, to provide habitations for labouring men.

5418. I suppose that getting the money is the great difficulty?—It is. As Mr. Clough said, the Act giving power to local authorities to establish model lodging-houses has only, to my knowledge, been availed of by Huddersfield. But in addition to the power to provide model lodging-houses, there is the power to provide habitations for labouring people; so that, as far as legislation is concerned, there is full scope for local authorities to avail themselves of the power.

5419. Do you not think that, if we wish to progress in our governing power, when Acts of Parliament have been passed, there should be some authority to see that they are not forgotten?—It is highly necessary. With regard to the Huddersfield model lodging-house, I may state that the total accommodation is for 155. With respect to the lavatories, it was a condition imposed upon us when we established the model lodging-house, by the then General Board of Health, to whom our plans had to be submitted, and by whom they had to be approved, that we should provide in every bed-room a lavatory. That was carried out throughout the house; but perhaps Mr. Clough is not aware that in the threepenny department all those lavatories are now closed; they are not used; they are boarded over. They were found to be a very great inconvenience in the place. Persons very often left the taps running, which flooded the place; and very often the pipes burst from frost; and many other evils and nuisances were caused by them of a nature which may be judged of from the class who frequented that portion of the house, so that the lavatories have been obliged to be disused. At present the lavatories are down in the basement story not in a very good place, but the best which we can have under the circumstances. The building before it was purchased had been a wool warehouse; it was the most eligible building which could be got at the time, but it is not a fair sample of what a model lodging-house should be.

5420. And what it might be, if you made it do now?—Just so. For instance, there is no drying-ground; there is nothing worth calling a yard for an airing ground for the inmates, they have to take exercise in the streets.

5421. You think that a much better plan could be adopted if you began at the beginning?—Yes.

5422. And with more advantage?—Yes.

The witness withdrew.

Adjourned to Tuesday, 6th November, at 11 o'clock, at Leeds.

Leeds, Tuesday, 6th November 1866.

PRESENT:

ROBERT RAWLINSON, ESQ., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, ESQ. | PROFESSOR JOHN THOMAS WAY.

LEEDS.

H. Oxley, Esq.

6 Nov. 1866.

HENRY OXLEY, ESQ. (Leeds), examined.

5423. (*Chairman.*) Are you mayor of Leeds?—Yes.

5424. How long have you been a resident in Leeds?—For 60 years, more or less.

5425. Are you connected with the trade of Leeds?—Only as a banker, not as a manufacturer.

5426. Were you cognizant of the condition of the river in your boyhood?—Yes, of the river Aire.

5427. What are the names of the becks?—There is what is called Beeston Beck, and Sheepscar Beck, and one or two other becks.

5428. Do they flow down through Leeds?—Yes, they flow down into the Aire at different points. But the becks that I would specially mention are those which run westward of Leeds, and which are connected with the manufactures of Leeds.

5429. What condition were they in when you first knew them?—I have caught little fishes in them as a boy.

5430. In what condition are they now?—Now, if you were to put your handkerchief in, it would come out blue in many cases.

5431. Within your own knowledge is the present state of the rivers and becks any inconvenience to the trade of the district; in other words, is the polluted water an advantage or a disadvantage to trade?—It must be a disadvantage to trade, and purer water is wanted.

5432. Within your knowledge are the rivers choked up and obstructed by the passing in of solids?—I cannot say that.

5433. You do know that the water is very much discoloured and thickened?—Yes.

5434. In summer time is it offensive or otherwise?—In summer time in some parts it is decidedly so, especially some of those small becks or rivulets.

5435. Do you know whether clean water is considered essential to any of the manufacturing processes of the district?—I should say that it is desirable in all cases.

5436. Have inconveniences been suffered within the borough of Leeds from the pollution of the river, and the water being rendered unfit for drinking purposes?—So much so, that I know formerly the water that was supplied to Leeds for domestic purposes was taken from the Aire; but it became so offensive that of necessity a different supply was sought for.

5437. Where do you take it now?—From the river Wharfe.

5438. Is that river polluted above the point where you take it?—I do not think it is seriously so; but to suppose that the sewage of Otley and Burley can go into the Wharfe without in some measure infecting the water is out of the question, and probably the mischief will eventually be much greater than it now is.

5439. Do you think that if it were practicable to prevent the pollution of the Wharfe above the point where your water supply is obtained without injuring trade, it would be desirable to carry out such a measure?—Unquestionably; but I would always speak with reference to trade; we must have trade.

5440. That is the first necessity of the country?—Yes; we live by it. If trade is to be injured by any measures that the Government may introduce, we shall be taking the butter and bread out of the mouth of the population; if we give them water we may be taking their bread from them.

5441. Would you not say that the first care of the state should be the health and morals of its people?—No doubt that is one of the primary objects of Government.

5442. If we speak as philanthropists, that is the prime object of life?—Yes.

5443. Any measures that will improve the health and inferentially the morals of the people, and not be otherwise injurious, would be advisable?—No doubt.

5444. Do foul rivers conduce to the health of the people?—No, the reverse of that.

5445. The author of any remedial measure must take into consideration the monetary effect upon the trade of the district?—Yes.

5446. If the remedial measure should prove to be ruinous, then it would be a question as to whether or not such a measure was worth having, or could be carried out?—I think it would be impossible to carry out such a measure if we took the opinion of the country at large; it would be destructive of trade.

5447. Men may be engaged in trades which produce enormous profits to individuals, but which at the same time work mischiefs out of all proportion to the benefits gained on unoffending individuals; for example, chemical manufactures have been carried on to the great profit of some individual, but to the destruction of property far exceeding in value the works where the manufactures have been carried on?—No doubt.

5448. In such a case as that should not the State step in and protect the unoffending people who are injured?—Yes.

5449. It may be an exceptional case?—Yes, I know there have been cases in which it was thought interference would be ruinous; but it has been found not only beneficial to the inhabitants, but profitable to the parties concerned. But, however, I do not say that that rule would apply in all cases. I think in some it would apply, and in some it would not.

5450. With regard to the casting into the river of refuse from the manufactures of the district, tanning and dyeing, and other processes which pollute the becks, and the casting in of sewage from the town or from individual houses, if all that can be prevented, not only without doing injury, but with advantages, do not you think it would be wise to prevent it?—I think so.

5451. Do you think it will be done if the state does not take any steps in the matter?—I could not say that that would be the case, because I have seen that from one cause or another, or from negligence, measures have not been taken which would be productive of profit to the individuals taking them.

5452. Do you find it difficult at any time to carry out preventive or remedial measures in your town council?—Do you mean measures to be passed in the town council?

5453. Supposing you have a question of river pollution, involving restrictions upon manufactures, or a question of smoke prevention, or other analogous questions, is there a difficulty in carrying a remedial measure through the town council?—I do not think there is really any practical difficulty about it. There has been some relaxation, or there was some, as to the smoke question some time ago, but that was because exceptions were made in our Smoke Act, and it was thought undesirable that smaller people should be made to consume their smoke at an expense which they felt, while some larger manufacturers, such as dyers and iron manufacturers, were allowed to exercise their free will.

5454. Taking it for granted that the town council or the town of Leeds is absolutely perfect, and that you are willing to do all you can to prevent these pollutions, does it follow that all towns above you and below you will follow your good example?—No; and

that is one of the difficulties we have to deal with. You may force a manufacturer just on this side of the boundary of the borough to do what he finds expensive, while a manufacturer immediately over the boundary may not do so; therefore, the one says, you put me to a disadvantage compared with my neighbour.

5455. Are there not some persons so forgetful of their duty to the community that, although they would willingly take advantage of an improvement carried out at whatever cost by the municipality, would not stir in the matter themselves unless they were put compulsorily under some regulations?—Yes, I think so.

5456. That being so, although some town councils may be willing to work out their own improvements, you can imagine that there may be other communities that would not be so willing?—I can easily conceive that, and I believe it. I think that there must be a General Act rather than a Local Act to effect these objects.

5457. You would have local powers conferred upon your municipality, but those powers should also extend over the whole drainage area, and be equally compulsory upon every manufacturer within that area?—Yes, there must be an Act to affect all manufacturers alike, otherwise you will place Leeds at a disadvantage, say with Wakefield, or give supposed advantages to Wakefield which Leeds does not possess. I mention Wakefield simply as one town; it might be Otley.

5458. Taking those views, do you think that the Crown was justified in issuing the Commission which is now sitting here to inquire into these subjects?—Perfectly so.

5459. It is our duty to consult the several interests throughout the district, to ascertain the views which are entertained, and then to frame such a report as we may deem advisable after we have received the evidence that may be offered, and recommend such restrictions, if they are to be called so, as shall be for the general benefit of the whole area?—Yes.

5460. The word "restrictions" may perhaps convey, if not explain, the idea of something unpalatable. I mean restrictions based upon common sense, and which shall be capable of being practically carried out?—Just so. My own opinion is that some measure ought to be passed which shall force, if you like to use that term, operations which can be fairly and reasonably carried out without damaging the trade itself, but which shall be beneficial to those who are not engaged in that trade, and to the public at large.

5461. With regard to the requisite machinery for carrying out such an Act, do you think that the controlling power should have its seat in the district, and be constituted by some form of representation?—I am hardly prepared to give an answer to the question,—whether such powers would be best left in the hands of a local body, or should be superintended and enforced by a general commission; it involves a good deal of consideration.

5462. If an Act in this country is to be beneficially worked, it must be in some degree in accordance with the spirit and feelings of the inhabitants of the district?—No doubt.

5463. (*Mr. Harrison.*) You say you remember when the river Aire was the source of water supply to the town of Leeds?—Yes, the supply was taken at Leeds Bridge.

5464. How long ago is that?—I cannot say exactly, but perhaps 25 or 30 years ago.

5465. Was the Aire a good source of water supply at that time?—No.

5466. Had it been deteriorating up to that time and for some time before?—With the increase of manufactures there is no doubt that the water would have deteriorated, and the increase of manufactures has been going on ever since I was a boy.

5467. Do you remember at any time when the Aire was a good source of supply to the town of Leeds?—Not in my time certainly.

5468. In consequence of the Aire being a bad source of supply, has the town of Leeds gone to great expense to obtain a good one?—It has gone to a large expense to obtain a better supply. I do not think it is a bad supply at present.

5469. Are there not many small towns and villages on the banks of the Aire that are not in the position of Leeds as to wealth, so as to be able to obtain such a supply as Leeds has?—Yes, there are but I apprehend that they take their supply principally from wells they have dug down.

5470. Do you know of your own knowledge that that is so?—I know that there are wells in various districts and little springs, but I cannot speak as to the exact state of the water supply of the many villages that there are in this neighbourhood. I know some of them are very indifferently supplied.

5471. You were speaking just now of the disadvantages of one town as compared with another. Are you aware that manufacturers at Wakefield are obliged at considerable expense to keep their ashes out of the river?—It was more in reference to the consumption of smoke that I spoke. I mentioned Wakefield simply as a town that happened to strike me. I might have named Huddersfield.

5472. Are you aware that many manufacturers in Huddersfield tip their ashes cheaply and easily into the river, whereas manufacturers in Wakefield are obliged at some expense to keep them out of the river?—I do not know that of my own knowledge, but I should say that they have no more business to but ashes into the river at one place than at the other.

5473. At present there is an unequal condition of things; the town of Wakefield is suffering from manufacturers at Huddersfield being allowed to create a nuisance from which manufacturers at Wakefield suffer?—Yes, and I think it ought not to be so.

5474. Are you aware that Wakefield used to be a town rather famous for dyeing?—Yes, I can remember the time when a great quantity of white cloth was made in Wakefield; it was a great district in consequence of its pure water and better cleansing.

5475. Are you aware that in consequence of the pollution of the river above Wakefield by the increase of manufactures, a good deal of that trade has been lost to Wakefield?—I can hardly say that it has been entirely on that ground. I think it was withdrawn from Wakefield, partly from the extension of manufactures elsewhere.

5476. The truth appears to be this that the existing and increasing pollution of the rivers caused by the manufacturing activity of some towns is actually doing an injury to other towns?—No doubt it must be so. I should say that Leeds would damage any town that carried on manufactures below it.

5477. Has not Leeds been injured by the increase of manufactures in towns above it?—To some extent it probably may have been, but I do not know that there are many large manufacturers above Leeds; there are manufactories at Shipley, but I do not know that that has been the cause of the pollution of the Aire to the extent that it is polluted. I think that the pollution of the Aire at Leeds comes more from our own immediate neighbourhood than from anything taking place above Leeds, unless indeed the river is polluted from Skipton.

5478. (*Professor Way.*) Is it not largely polluted by the sewage of towns above quite apart from manufacturers?—It must be, naturally so, and the greater the population the worse that must be.

5479. Does not Bradford drain into the river?—Yes, and that can do us no good. I should say that the pollution of the river Aire is increased year by year, as there are more waterclosets being continually constructed in the town. The greater part of the sewage of the district which was formerly led away by carts is now carried into the Aire.

5480. Any steps that may be taken to prevent pollution of rivers by manufactures should also be made applicable to the prevention of pollution by town drainage?—Yes, I think that that is the worst source of pollution in many respects.

The witness withdrew.

LEEDS.

W. Ferrand, Esq.

6 Nov. 1866.

WILLIAM FERRAND, Esq. (St. Ives, Bingley), examined.

5481. (*Chairman.*) Where do you reside?—At St. Ives, near Bingley, in Yorkshire.

5482. Is that situated upon the river Aire?—I live about a mile from the river.

5483. How long have you been acquainted with the river Aire?—Ever since I was a boy of seven years of age.

5484. You have known the river Aire for so many years above and below and opposite Bingley?—I have.

5485. In what condition was that river in your boyhood?—It was a beautiful clear river, and it contained great quantities of trout, grayling, eels, and cray-fish.

5486. At what date would that have been?—I remember it from the year 1817 to 1826. I resided on the banks till I was 17. I was then absent from it for three years, but was in the habit of repeatedly fishing in it for those three years; from the time when I returned to this time I have lived close adjoining to it.

5487. At what date did pollutions commence to affect the river?—Pollutions began to affect the river about the year 1830 from Bradford, below Bradford beck; above Bradford beck I cannot say that there was any appreciable pollution till about the year 1840.

5488. Increased pollution of the stream took place simultaneously with extension of trade and manufactures, and the building of mills?—Exactly so.

5489. Will you state shortly what the pollutions are?—There is town sewage and refuse from wool-washing and dye water, but not above Bradford beck. Below Saltaire there are large dyeworks, above Saltaire there is no dye refuse that is appreciable in the river Aire.

5490. The river is polluted by fluids; is it also obstructed by solids?—Yes, to a most serious extent.

5491. Are you a riparian owner?—I am, for three or four miles of the river Aire.

5492. You being a riparian owner consider, no doubt, that at present you have the privilege of doing what you think proper with that part of the river, that is within the bounds of your property?—Yes.

5493. You can embank it, or encroach upon it as you please?—Yes.

5494. Should you feel at liberty to tip foundation material into it if you were building?—I could do it.

5495. You are not aware of any restrictions?—There is no legislative restriction to prevent it.

5496. There is no authority that does prevent it?—No.

5497. Will you describe the kind of solids that you find are thrown into the river, obstructing its flow and raising its bed?—There are some parts of the river Aire near Bingley which, when I was young, were five or six feet deep in water. They are now in the summer months bare beds of stone and mud banks and fœtid filth.

5498. When you first knew the river, if the water happened to be low you had a bright clear and sparkling bottom?—It was a beautifully bright clear river with a sandy bottom, and the bed was covered with round stones and beautifully clean.

5499. If the water is low now in summer what is the character of the bottom?—The water at the bottom is sludge, and the stones are covered with filth, which, when exposed to the air, cracks into innumerable pieces, and the stench is quite disgusting; and then there are solids of various kinds thrown in.

5500. Will you describe them?—Yes, I can give you the solids that are turned in. At Keighley engine ashes, house ashes, foundry dross, building foundations, and cellar diggings; broken bricks and stones from old and new buildings; old iron pans, skips and chimneys; broken chimney pots, flowerpots, drain pipes, crockery, and glass bottles; zinc, and tin cuttings, and every kind of refuse. If you will allow me I will produce before you what I took out of the river on Monday last (*producing a bag-full*). That (*pointing to a mass of 8lbs. or 10lbs. weight*) is foundry dross washed down the river Worth at Keighley. I took it out of the bed of the river about 100 yards below the mouth of the river Worth, upon which the town of Keighley stands.

5501. Have you any idea what is the name of the works or district where that foundry dross comes from?—It come from the town of Keighley; there are now large iron foundry works there, and they throw in engine ashes, or any other kind of refuse; they pitch it on the banks of the river Worth.

5502. Or lay it on the margin of the river?—They do not lay it to any great extent on the margin; they lay it on to the bed of the river for three or four yards broad at the foot of the slope; they pile it up yards high.

5503. And the floods undercut the bank and let it fall down?—Yes, but the floods cannot take it away; they send men to shovel it into the mid stream; the men pitch it in with their hands, and down it goes into the river Worth, and is forwarded to the river Aire.

5504. (*Professor Way.*) Was that mass so brought down?—This has come more than a mile down the river Worth into the river Aire. I went there yesterday week to examine it; there are I suppose from the town Keighley, at the mouth of the river Worth, and for a mile down the river Aire, thousands of cart loads, which have been turned into the Worth and the river Aire within the last few years; but you see this has been rolled down with the force of the stream, which is an inclined plane, into the river. I saw this just rising out of the water. The bed is stowed all round with this kind of dross, and engine ashes, which I have not brought—bricks, and the kind of refuse I have described. I lifted this up just as you see it, and out it came of a deep hole. I took this (*pointing to another piece*) out of a bed of solid refuse, which some few years ago I remember being 3 ft. or 4 ft. deep in water. This foundry dross is now allowed to roll into the river, and of course it is filling up the deeps in that place. A considerable portion of the land on the banks below there is my property; this (*pointing to the same*) being a heavier substance than engine ashes, has not been met with in the neighbourhood of Bingley, or any considerable distance lower down. I believe that the iron foundries at Keighley have not been carried on to any great extent till within the last few years. Besides what I have produced, I saw on this very bank an iron pan that would hold I would say eight or ten gallons. There were several holes in it, and therefore it had been thrown away; but this iron pan had become full of refuse, and it was filling up the bed of the river. I also saw an iron chimney pipe, several feet long, worn out and thrown away, which had been carried down by the flood. I saw an iron frying-pan, and a considerable quantity of other iron refuse.

5505. (*Chairman.*) We may take it generally that the river is fouled by the throwing in without stint of such refuse as you have produced and spoken to?—Yes.

5506. Whether they throw in one ton or a million, it is entirely at their option?—Everybody in the town of Keighley deliberately goes to the river Worth, or Keighley Beck, and empties into it what they think proper. I was called to Keighley a few months ago, as a magistrate, to hear some charges that were preferred by the Keighley local board of health, against some manufacturers in the town of Keighley, for obstructing the river Worth. Being a person interested in the river I declined to act, and with difficulty we found two magistrates, who were considered disinterested persons. They heard the case; and the defence was that the Keighley local board of health themselves violated the law, by setting the example, and throwing whatever refuse they thought proper into the river Worth.

5507. In such a case as that, you would probably consider that local boards would require to be put under restraint as well as individuals?—Most decidedly.

5508. That the law should be restrictive upon public, as well as private individuals?—Exactly, and I will give you my reason; the Keighley local

board of health is appointed, I may say, under strong local feeling. There are indeed some members of that Board who have been extremely anxious to introduce a system of filtering sewage, and also of stopping refuse from being put into the river Worth. A gentleman in Keighley, a large manufacturer, took a very active part in endeavouring to put a stop to this filling of the river Worth with refuse. He went into the town of Keighley, and complained to the inhabitants, and begged and entreated that they would no longer act in this manner, pointing out that it was a violation of the law, and that his property was so seriously injured, that he should be obliged to appeal to the law for protection. The chairman of the local board of health came out of his house, and said to this gentleman, "What! you put a stop to our putting ashes into Keighley Beck?" and he ran into his house, and he brought either a skip full of ashes, or a shovel full, and pitched them over the bridge into the beck, and said, "Now go and do your worst." And from that time they have done their worst, for every person has acted as I have described to you. I was going to say, that when a certain number of the members of the Keighley local board of health wished to put a stop to all these nuisances, they were defeated by a majority of the board; and I believe that if the question was left to the Keighley local board of health, you never would have a stop put to these nuisances, or to the obstruction to the river, because it would be made a matter of personal contest annually, in the election of the board of health.

5509. Then the conclusions you have arrived at are that there must be an independent authority, having jurisdiction over corporations and local boards, in case of river pollutions?—I should recommend Government inspection; and my impression is that Government inspection can never be satisfactorily carried out, unless it be also placed under the local direction of the magistrates. Whether in a town like Leeds, you would place the direction in the hands of the borough magistrates I do not know, but I should say it would be very proper to do so. I see no objection whatever to that, but it must be remembered that a great part of these nuisances arise where there are no borough magistrates, but only county magistrates. I may state, that live dogs and cats are thrown not only into the river Aire, but into many of the little becks and feeders of the river; dead dogs, cats, pigs, sheep, and calves are thrown both into the feeders and into the river Aire, for which there is no penalty whatever; and the summer before last, when I returned home from Parliament, after having served a considerable length of time upon a sewage committee, I took a walk on the banks of the river Aire, and I saw two putrid sheep, and a putrid pig lying upon one bank, and I could smell them long before I came in sight of them. I might add that the first flood that comes after a drought of several weeks, which is frequently the case, washes these dead carcases into the deeps about Leeds, where they stop in all probability, and produce a serious nuisance.

5510. There is no systematic scavenging of the river?—Nothing; the water of the river is left to scavenge itself.

5511. There is no authority whose duty it is to take out these carcases and bury them?—None whatever. I would suggest the desirability in the valley of the Aire, and in all these manufacturing districts, of sanitary reservoirs, for the purpose of cleansing the beds of the rivers and of their feeders by flushing. It must be remembered that now the water supply is becoming of such importance in these densely populous districts, that we have had reservoirs made to collect the water. Before they were made, a thunderstorm was of vital consequence to the health of those manufacturing districts; the water rushed down into all those becks and feeders, and into the river Aire, sweeping the filth before it, and carrying it down to the levels towards the sea. Now when we have a heavy thunderstorm in my neighbourhood in the summer months, we very seldom find that it has any appreciable effect in cleansing the becks or the rivers, for those large reservoirs stop the waters in their course, and by the time the thunderstorm is over, you may go and look at one of those reservoirs and you will find that it has been filled to the brim by the extra fall of water, but the becks below those reservoirs remain in the same filthy state they were in before. A thunderstorm has very little effect upon the river Aire, comparatively speaking.

5512. I suppose that is a matter of engineering detail for future consideration?—Exactly.

5513. If you prevent pollutions going into the rivers, there will be less necessity for flushing them out?—Decidedly.

5514. Perhaps prevention will be the cheapest and best remedy?—Yes.

5515. In dredging the beds of the rivers and streams to remove those accumulations and solids you have spoken about, have you experienced on your own estate or elsewhere any flooding of adjoining lands caused by the bed of the river having been raised?—No doubt of it. I may mention that some gentlemen living upon the higher part of the river Aire, in the neighbourhood of Skipton, obtained an Act of Parliament some years ago for the purpose of draining their land; they were called the Airedale Drainage Company. A Committee of the House of Commons, without at all considering the real merits of the question, or the claims of the inhabitants living below where this drainage took place, reported in its favour, and the Act gave the company the power of cutting off three miles of water between the Keighley Beck and the town of Skipton. The consequence has been that they have drained the valley of the Aire between Skipton and Steeton already, by causing the water to flow with far greater rapidity down to the land below. My property commences a short distance below the mouth of the Keighley Beck, and that beck has been filling up now for two or three years so rapidly, as well as the river Aire down below it, that what with the river Worth rushing down from Keighley, and the river Aire rushing down from a higher portion of the valley, the water opposite to Riddlesden, where the mouth of the beck of the Worth is, has risen much higher than it used to do; it flows down over the bed of the river with great force; it is now back-watering for two miles below, and the consequence is that the foulness that comes down from Keighley is spread over the land, and we are not only getting a flood on the land, but a flood of polluted water. The other day I walked through the water, shooting; and I can assure you that it was then several inches deep in many parts on both sides of the river Aire. I walked on the furrows in a potato field, and the water was three or four inches deep on each side, and there was quite a disagreeable smell from it. One reason why the Committee of the House of Commons reported in favour of the bill I have referred to was that medical evidence was produced from Skipton to show that they were suffering seriously from typhus fever in that neighbourhood, in consequence of the land being flooded; it was shown to the Committee that the bill would only remove this nuisance from Skipton down to the neighbourhood of Keighley. A question was put to Mr. Bateman, whether this river could not have been cleaned out by the proprietors for a few thousand pounds, so as to have lowered its bed, and let the water come down its natural channel, instead of going to the expense of 60,000*l.* as this company proposed to do.

5516. This I suppose may be regarded as a bygone matter?—Yes, but I was going to point out to you the effect of the owners of one portion interfering without the interest of those below them being considered.

5517. Without a full scheme?—Yes; we at that time proposed a full scheme. What I would suggest to you is this, that all owners of property on the banks of rivers should be compelled to keep the course of the river clear so far as it passes by their property. If you compel manufacturers to keep out the refuse

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which is now turned in, proprietors on the banks should be compelled to remove all wreck and fallen timber. Excepting myself, landed proprietors in this neighbourhood, as long as I can remember, have never once thought of clearing out any fallen timber. I have seen in the river Aire, in the neighbourhood of Skipton, large trees which have fallen in, reaching two thirds perhaps of the way across the river, and those trees have remained there year after year, no one making any attempt to remove them, because the timber would not pay the expense of doing so. I would suggest that whatever bill might be brought in by the Government, owners of riparian land should be compelled to clear the beds of the rivers, and if they should fail to do so, then I should recommend that a Government inspector should be empowered to do the necessary work, compelling the owners on the banks of the rivers to pay the expense.

5518. Have any special works been carried out in the town of Keighley ?—Yes, lately there have been some.

5519. Of what description ?—I can only describe them in this way; there was an old drain that carried a portion of the drainage of Keighley into the river Aire, and lately the authorities have carried out considerable drainage or sewerage works in the town of Keighley, and they have brought down the sewage of the town, and a large amount of manufacturing refuse, by a culvert, and turned it into the river Aire, a few yards above the mouth of the Keighley Beck.

5520. What effect has that had upon the river ?—The effect is most extraordinary. Not long ago I saw gases floating on the surface of the river.

5521. You mean, I presume, that you saw evidences of gas of an iridescent colour ?—Yes, I saw gas-tar or refuse, a kind of thick fœtid substance, of about eight inches in depth; that was between 1 and 2 o'clock in the day, when the mills were standing, and the water had fallen. I stooped down to look into this culvert, and I saw above the water human excrements sticking to the walls on each side, and I can assure you that the smell was horrible. I may state that Mr. Lister of Bradford erected there a few years ago some very large greaseworks, where grease is extracted from wool washings; this filth is let out at certain periods, and it comes down to the river Aire, and I have seen it kill fish; I have seen fish turn up scores of yards below the mouth of the culvert where it came in.

5522. Turning from the question of pollution to remedial measures, you have had, I believe, considerable experience in Parliamentary committees when inquiries have taken place relating to utilization of sewage ?—Yes.

5523. I believe you were a member of one of the committees which inquired into the proposed utilization of the metropolitan sewage ?—Yes.

5524. Did you arrive at any conclusions from the evidence given by witnesses examined before that committee ?—I did.

5525. Were they favourable to the utilization of sewage or otherwise ?—Decidedly favourable.

5526. Are you of opinion that the sewage of towns may be profitably utilized if land can be found favourably situated, and proper means are taken ?—I am of that opinion, and I think that the valley of the Aire is admirably situated, with regard both to the towns adjoining the Aire, and the manufacturing villages on the hill sides, for carrying out a system of filtering and irrigation in many parts. Upon the high lands in my neighbourhood irrigation is carried on to a considerable extent with the greatest profit and advantage. I may mention that I convey the sewage from my own house and my farmyard on to some land which I own below it, and by the system of irrigation I can annually produce now upon only four or five acres of land a quantity fourfold of that which the same land produced before. I have had pipes laid down which convey the washings of the farmyard, and also all the sewage from the house, the sinks, the laundry, the brewhouse, and the waterclosets, into one cistern, where a mixture takes place of what comes from the farmyard and from the house. This is carried on to the land by open drains, within half a dozen yards of one of our prettiest walks, where ladies are passing and re-passing repeatedly during the day; I do not believe that any one of them has ever yet discovered any disagreeable smell.

5527. The land absorbs the liquid and destroys any noxious smell ?—It does entirely. I know by experience that you may walk over the land and you cannot discover the slightest annoyance. No doubt if you were to put your nose down near the mouth where the cistern is, you might distinguish a foul air coming out of it, but you cannot smell anything half-a-dozen yards off.

5528. If any person should state that sewage irrigation must necessarily be injurious and offensive, should you be inclined to think that the system was not properly carried out, or that such persons were correct in their opinion ?—I think that a great deal depends upon the strength of the sewage, and upon its proper dilution. I can give you as an instance the village of Wilsden, which is not any great distance from where I reside. There is a population there of 3,000 persons, and the sewage to all that village, with the exception of a few cottages, is conveyed on to some land of which I am the owner, but which is let to a tenant; he has had the sewage laid upon a meadow, and some pasture land besides, to the extent I suppose of perhaps 15 or 20 acres, and during the whole of the summer, as well as in the winter, this sewage has been laid upon the land; I have repeatedly driven Mrs. Ferrand, who suffers from delicate health, along the road near to which this sewage has been laid on the land; there is nothing but a wall between it and the road, and I have never once heard her complain of feeling any annoyance from it.

5529. Your experience then is that sewage irrigation may be carried on, if properly conducted, without doing any injury, or causing any nuisance ?—Decidedly.

5530. And with decided benefit to the person carrying on the operation ?—No doubt of it.

5531. What do you grow from the application of your sewage ?—Mine is ordinary pasture land, but I may say that I have laid it on to the ploughed land; not the sewage from my house, but from the dog-kennels; I have laid it on to the ploughed land, and it is quite extraordinary to see the crop of turnips that is produced from land which this sewage has gone over.

5532. Might not such sewage be beneficially used for green crops, as well as for grass ?—No doubt of it. To refer to the town of Bingley, the sewage there could be conveyed on to land at a moderate expense, and that land which lets at 50*s.* or 3*l.* an acre, would be then worth, for market gardens, I have no doubt, 15*l.* or 20*l.* an acre; I state this in consequence of the evidence and facts which were brought before us when I was a member of the Committee which sat on this subject in the House of Commons.

5533. Do you think that the Keighley local board could find means to utilize the sewage of the town if they were compelled to do so ?—Yes, with the greatest ease; I believe they have had the advice of a surveyor, and of my own agent, Mr. Booth, of Halifax, and I think he says that with a few cisterns they may filter all the sewage of Keighley, and they wish to do so; two thirds of the gentlemen who are engaged in trade in Keighley are anxious for it, but it happens that they are opposed by the Keighley local board which, as I have before stated, is a board elected under somewhat strong feelings in the town. Before I leave this subject, I should like to describe to you the process by which I carry out the filtering, and which I should suggest for the application of town sewage; I should recommend certain rows of tanks gradually falling on an incline, capable, say, of holding the sewage for one day. I would bring the solids in there (*describing by a sketch,*) and if

necessary let the solids go into two tanks; I would then have earth, house ashes, saw-dust, and road scrapings, which had been kept dry under sheds, placed in the lower tanks, and I should let the sewage run from one into the other until they became thoroughly full, and the earth contained as much sewage as it could, and by the time it had run through three or four tanks it might be conveyed into the river Aire, and it would run out as pure I believe as water well could be, indeed as clear as water itself.

5534. That you believe would be the result from filtering?—Yes.

5535. That would not be irrigating?—No, I am now talking of the filtering process; I believe that the town of Keighley, with four of these rows of tanks, would be able to filter all its sewage, and more than that, they would make many thousands a year by it. That is my belief, from the trade which is carried on there and the improved style of houses which are built there, all with waterclosets. If it was found afterwards that the water was not sufficiently clear by this filtering process, they might easily, by the use of hose pipes, convey the water into the valley below, and lead it on to pasture land; I have seen that carried on in my own neighbourhood, filtering refuse from mill dye water, and the water has come into the stream as clear as water could be.

5536. At whose mill was that?—At Messrs. Townhend and Cullingworth's mill, near Bingley.

5537. Is the process now in operation?—Yes.

5538. (*Professor Way.*) You say that filters are made for the purpose of purifying dye water?—Yes; dye water and refuse from wool washing are completely cleansed out, and the effluent water comes out perfectly clear.

5539. By passing through a filter of earth?—Yes, and that is done for months of the year together.

5540. Is it an expensive process?—No, it is a very reasonable one. The plan is set forth in a letter which Mr. Townhend addressed to me, and which was laid before the committee that sat in the House of Commons; it will be found upon the minutes of their proceedings.

5541. Do the filters occupy much space?—No, they do not.

5542. Is the mill to which you have referred a large one?—The works are very large now, and they have been increasing them. I am sorry to say that I have been obliged to resort to legal measures upon this subject, and the case is now before the Court of Chancery. For years (and this the defendant admits himself) the water was perfectly clear, and I can vouch for that.

5543. (*Chairman.*) I suppose the common law of England is strong enough at the present time to prevent nuisances?—Yes, if it can be carried out.

5544. The machinery is difficult and costly?—Yes.

5545. And necessarily involves the action of individuals?—Yes, it creates a great deal of bad feeling, and it is far better avoided if possible.

5546. You would perhaps say that prevention of river pollution and nuisances requires some machinery which would remove responsibility from individuals and odium from neighbours?—Exactly so. There is another thing that I wish to mention. At many manufactories in large towns the excrements are removed in barrels at an annual cost, and I believe some millowners receive as much as 10*l.* a year, or even more than that, from the farmers. They bring barrels and place them at the foot of the privies. There is a little iron plate, of no great size, which is just drawn out, and a tube conveys the soil into an open space at the top of the barrel, and it runs down there until it is nearly full; then the iron plate is pushed back again, and a man conveys this barrel through villages and towns to the very great nuisance of the inhabitants. The smell is quite disgusting. The farmer carries the soil to his field and mixes it with dry earth. He then allows it to remain close to the roadside during the winter and until spring; then he leads it on to his land.

5547. Have you seen any of the dry-earth closets?—I have not, but I have heard of them.

5548. (*Professor Way.*) The method which you have just described, of carrying away the excrements into the country, relieves the river of course to that extent?—Yes.

5549. Is it not the fact that urine is collected from cottages and used in factories for washing wool?—That is not so much done in my neighbourhood as in the woollen districts where cloth is manufactured.

5550. So that in one case solid excrements are taken from the mills to the country, and in the other case the liquid excrement is brought from the country to the mills?—Yes, the latter is necessary for trade, and I feel sure that no man would object to anything of that kind as far as urine is concerned.

5551. (*Mr. Harrison.*) Do you remember the manufacturing process carried on in this neighbourood before trade was concentrated in large mills?—Yes.

5552. What used they to do with the refuse arising from cleansing cloth and dyeing it in those days?—I live in the worsted district, and I have not been much in the cloth manufacturing districts.

5553. What used they to do with soap and other refuse from the worsted manufactures?—In my young days there were very few mills, but now there are a great number of mills. When wool-combing by hand took place you generally found what was called a wool-washing shop on a part of the premises, and below this wool-washing shop there was generally a tank or pit dug out of the earth, which was 15 or 20 feet long and 3 or 4 feet deep. A drain was made from the wool-washing shop to the edge of this pit, and the master manufacturer would fill the pit to about one-half of its depth with soil, and when the soapsuds saturated this soil thoroughly the pit used to be cleared out, and the contents were carried on to land; then fresh earth was put into the pit, and the same process went on. It was a very rare thing for any person in those days to turn soapsuds into the river or the beck, because they were considered too valuable.

5554. Did the water from those tanks pass off clear?—There was very little in some, except what came from the wool-washing. Then when hand wool-combing ceased, and wool was combed by machinery, manufacturers began to comb much more on their own premises. Before that time a great portion of the wool-combing was scattered over the country; people used to comb the wool in the villages, and they were called basketers from the basket of wool they carried on their shoulders with 3lbs. or 4lbs. of soap for washing it. But the farmers found it to their interest to provide them with wool-washing shops on the slopes of the hills, and then the soapsuds were run on to the land. Since it has become the practice to extract the grease we have had built large sheds for wool-washing and extraction of grease, generally on the edge of some stream, and all the refuse which is valuable for tillage goes into the river and causes a great deal of nuisance, of which the public now complain.

5555. Are you well acquainted with the villages in the neighbourhood of the river Aire?—I am in the parts higher up the river.

5556. How are the villages adjoining the river supplied with water?—They have a large number of springs. The mayor of Leeds, who was examined, alluded to some wells, but we have not many wells; we have a great number of surface springs that come out to the day upon the hill sides and run down towards the houses.

5557. Are the people generally speaking well supplied with water and not dependent upon the river Aire?—No. I know of becks in my neighbourhood from which the people have constantly taken water for household purposes, but now they never think of doing so, and many of them are put to great inconvenience because they have to go a considerable distance to get water.

5558. What did you mean when you spoke of a company above having cut off the water between Keighley and Bingley?—They obtained powers to

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cut the river straight, so that every gentleman on the banks of the Aire, between Leeds and Skipton, was deprived of three miles of water power, and to my astonishment there was no movement made, except by myself, with a view to stopping it. The Commissioners will perceive that as a matter of health those three miles of water power were of vital importance to the district. What I mean will be seen by referring to this map; they cut off the whole of this bend (*pointing to the map*).

5559. They could not take away the fall?—No, but they took away the whole of this water for the use of the mill dams, and if they carry out the whole of the scheme it will deprive the millowners in this valley (*pointing to the map*), the town of Leeds, and very populous districts on the banks of the Aire of three miles of water.

5560. (*Chairman.*) How many landowners were involved in the scheme you have referred to?—There were six or seven of them who got up this scheme. They let all this water down by a straight line upon me and upon other landowners situated below, and the scheme has been a great failure.

5561. Did the question of a majority or a minority arise as to the adoption of the scheme?—Not at all. The parties went to Parliament and a committee was appointed, and the promoters induced the committee to approve of their scheme. We complained that the landowners below had never been consulted.

5562. Were the landowners who possessed those particular estates benefited by what they did, irrespectively of landowners above or below them?—Yes.

5563. Were they at all opposed in Parliament?—Yes, I opposed them in the committee, and a clause was given to me to the effect that these parties were to pay me ample compensation for all the damage they had done me and my tenants.

5564. (*Mr. Harrison.*) Is it the fact that from the river having been straightened above, or from Keighley refuse filling up the bed of the river, your lands on the sides of the Aire are more flooded now than they used to be?—Yes, combined with letting the water down as is now done. Instead of the water going through all these bends (*pointing to the map*) as it did before, and coming down slowly, it now comes in a straight line which they have artificially made; it comes down like an arrow.

5565. Is it the fact that your land is now more flooded than it used to be?—Yes, and most seriously so.

5566. (*Professor Way.*) They have removed an objectionable state of things from themselves and have thrown it upon you?—Yes; but they have a sparse population in that neighbourhood compared with us.

5567. That is one of the cases for which an arrangement should have been made under a general scheme?—Yes.

5568. Such a result would not be possible if the river were placed under proper control?—No; that is exactly what I mean. I mean to say this, that if we had had Government inspection throughout the country that which occurred would never have been allowed, nor would there have been the same risk of typhus fever at Keighley and below there as Skipton was stated to have suffered.

5569. Have you had any experience of the use of dye water on land, or has it ever been used within your knowledge?—I have heard that it has, but I have no personal knowledge of it.

5570. The flooding of the land which you have spoken of with the foul water of the river would, under certain circumstances, I suppose, be rather advantageous if it came at the proper time?—Yes; and in this way, if you could flood the land and let the water sink into it, it is very well; but if the water is exposed to the sun the matter it contains will decompose, as has been the case during the last summer.

5571. You do not wish, I suppose, to convey the impression that there was injurious matter in the water, but that the water came on at an objectionable time?—I think you will agree with me in this, that when sewage is placed on land it must sink into it, and when the land has become completely saturated with it you must remove it to another place.

5572. We are not to suppose that the matter which renders the river Calder impure will be necessarily injurious to land if the liquid be properly applied?—No, I believe it would be most valuable. But there is another way in which the foul condition of the river is a serious injury; I mean to farmers who are prevented from watering their cattle. During the summer months, in the deeps below Keighley, I have frequently seen cows on a hot day go to the brink of the river, put their heads down and smell it, toss their heads up a few times, and then walk away.

5573. (*Chairman.*) You mean that the polluted water prevents its use for agricultural purposes and for cattle?—Yes.

5574. And therefore it is injurious to agriculture?—Decidedly it is during summer months. I cannot say that I have seen anything of the same sort in winter, but I have seen it in the summer frequently.

5575. Must there not have been something exceptionally bad in the river water which induced the cattle to reject it, or do cattle usually reject polluted water?—I have seen cattle drink water out of a rut in the road when it has been quite dirty.

5576. Will they not drink it out of a farmyard pond into which dung has drained?—Yes, I have seen them do that.

5577. Could it be acids from bleach and dye works which made cattle reject this water?—No; there is nothing of that kind at Keighley. I believe the pollution is caused by Mr. Lister's greaseworks. I have observed the stench of the water hundreds of yards from the river, when a flush of water has come down from his works, and the cattle would not drink it.

5578. The cattle reject that particular water, not because they will not drink polluted water, but because there is some special pollution in it?—Yes, I have no doubt of it. I have alluded to the dyeworks of Messrs. Townhend and Company. The water flows down through my property, and I have seen the cattle there in scarce times refuse to drink the water; there is dye water there and soap washing.

5579. (*Professor Way.*) I suppose there is a difference between the kind of polluted water that cattle will not drink and sewage?—My firm conviction is that during the summer months, with the sewage of the town of Keighley running into the river Aire, no cattle will drink the river water in the deeps below the outfall.

The witness withdrew.

FRANCIS DARWIN, Esq. (Creskeld near Otley), examined.

F. Darwin, Esq.

5580. (*Chairman.*) Are you in the commission of the peace?—Yes. I am a magistrate for the West Riding.

5581. Where do you reside?—At Creskeld near Otley.

5582. How long have you known the river Aire near Castleford?—I have not known it for more than 10 years.

5583. Do you know it intimately in that district?—Yes; my attention was first drawn to it when the cattle plague broke out; at that time I was chairman of the bench of magistrates for the West Riding. We assembled at Leeds in consequence of the outbreak of the disorder among cattle, and then I thought it my duty to go and look at the state of the river, it having been asserted that the condition of the river was the cause of the outbreak of the cattle disease in the Thorpe Hall Pasture.

5584. What opinion did you form upon that question?—I should hardly go the length of saying that the river was the cause of the disease breaking out among the cattle, but I do think it was the means of its being so excessive as it was there.

5585. You think it intensified the disease very much?—Yes; I went down twice to look at the place, once with the superintendent of police, and

once alone. Before I went down, I think it was in the month of August of last year, he advised me to take my luncheon, for, he said, he was quite sure I should not be able to eat it when I arrived at the river side. We went down to the Thorpe Hall Pasture, which is about a mile down, and the river was in a very low state (I am referring now to August 1865, more than a year ago, to that dry season when the cattle plague was so bad here). On arriving at the mouth of the place where the sewage of Leeds is cast into the river, I certainly was very much astonished.

5586. Did you notice the character of the pollutions you found there?—I observed human excrements and carcases of dogs and cats, and I may say that I never saw anything so frightful in my life; every eddy of the stream was manifestly full of human excrements of the most terrible kind.

5587. What state is the river in at Castleford?—I have never been down there; I have not been lower down than Swillington Bridge, that was the extent of our jurisdiction.

5588. Is your immediate residence near any part of the river?—It is not near the river Aire; I reside in Wharfedale near the river Wharfe, distant about nine miles from this place.

5589. Are you one of the visiting justices for the Wakefield house of correction?—Yes.

5590. What system have you carried out there with reference to the drainage and sewerage of the prison; have waterclosets been introduced into any of the cells?—In a great many of them the old waterclosets are in existence, these are connected with the main sewerage of the town of Wakefield, and are discharged in the ordinary way. Lately we have ordered a great many of Mr. Moule's dry earth closets, and I have had many conversations with Captain Armitage, the governor of the gaol, upon the subject of them, and he, after a fair trial of them, considers them extremely valuable. He informs me that there is no smell in the cells, and he thinks that there will be no difficulty in carrying the system out in such an establishment as his.

5591. Is it the intention of the magistrates to give these earth closets a fair trial in their large gaol?—The governor of the gaol informed me that they were going to make 800 of them, and to give them a fair trial. I believe they have made arrangements with the proprietor for the payment of a royalty so that they may manufacture them in the gaol. I received a letter from him the other day, in which he said, "We are hard at work making new earth closets."

5592. Will you be kind enough to inform the magistrates that the Commissioners will feel very much obliged if they will communicate to them their opinion of the result of the experiment?—Yes; I will write to Captain Armitage on the subject.

5593. Are you acquainted with the upper part of the river Calder?—Yes; I have some property there where the rivers are still quite pure; it is in the neighbourhood of Hebden Bridge, the streams are beautiful there, but there is a practice of throwing ashes in, and so getting rid of a nuisance in flood times.

5594. As a riparian owner, do you think it desirable that the rivers should be left in the state they are now in without any supervision whatever, persons being suffered to do just as they like?—No; I do not, for if they are left in their present state they will soon I think become choked up; that is to say, unless the beds of the rivers are kept clear by artificial means, the present system of casting refuse in will raise the lower portions of the beds of the streams.

5595. Are there any ironworks or coal mines in the district near the river?—No; there are cotton works.

5596. Are you acquainted with the streams that flow through Yorkshire generally?—Yes; with a great number of them.

5597. Do you know some of them in which it would be of no use to fish?—Yes; the greater portion of them.

5598. Are there any other special points that you wish to speak upon?—I observe that your instructions refer to the supply of water as well as to the state of the rivers. I reside close to the Arthington pumping station, where the present Leeds supply of water is obtained. The river Wharfe is another river which is rapidly deteriorating in quality on account of the increased number of manufactories at Otley, which communicate directly with the river.

5599. Have you heard complaints as to any injurious effects from the abstraction of water at the pumping station?—We had a meeting at Wetherby of the landed proprietors last Wednesday, when that very matter was discussed, and we had an interview with Mr. Filliter, the surveyor of the borough of Leeds, and Alderman Carter, upon that very point, and our opinion was, that considering that Bradford has already obtained large powers for removal of water from the watershed of the Wharfe, and that Leeds was asking for additional powers, it behoved us to ascertain what the effect would be on the river Wharfe.

5600. You mean, I presume, the prospective effect of something that is proposed to be done?—Yes; I have never heard of any inconvenience being found from the existing abstraction of the water.

5601. Do you know how much water the Leeds waterworks have power to abstract, have they not power to abstract 6,000,000 gallons?—I do not think they have actually abstracted that quantity of water.

5602. It is proposed to abstract an additional quantity at some other point?—They propose to go higher up to a tributary called the Washbourn, and from that to obtain a purer supply of water than they are able to obtain at present from the river itself, which bears along with it contaminations which have been gathered at Otley, Addingham, Post, and Burley. At present I believe they have been taking somewhere about 4,000,000 gallons, and their proposal is to take 8,000,000 gallons in addition to the 6,000,000 that they can take now, or in other words 14,000,000 gallons a day from the river Wharfe; the Washbourne is a very important tributary to the river Wharfe.

5603. What do you think will be the effect upon your streams and rivers if that scheme is carried out?—The proprietors below think that if that quantity of water is taken away from the river it will subside into a mere inconsiderable stream; it will be no longer a barrier between one estate and another, and great expense for fencing will have to be incurred; besides that we should have all the drainage of those places cast down the river, with a diminished supply of purer water than heretofore to dilute it. As we have seen the effect produced upon gentlemen's estates on the rivers below Leeds, we dread that a similar effect will be produced at some future time upon the property on the river Wharfe below Otley. Some of us, and I among the number, entertain no doubt that this matter of the supply of water to towns ought to be taken in hand, not by local authorities so much as by the Government, and that in fact water-supplying districts should be established in the same way that water removal districts are established in Bedfordshire and Lincolnshire where there is an excess of water at a low elevation.

5604. You mean the commissioners of sewers as they are termed?—Yes. There are many large villages besides the two boroughs of Bradford and Leeds which I believe are very inadequately supplied with water, while their populations are increasing rapidly, and it would be in my opinion a great saving of expense and a great benefit to a large number of persons if for those districts there was made one water supply, and if it were not left to individual towns to get large supplies and seize hold of the best, and have a monopoly of the supply of water.

5605. The supply of water is essential, I suppose, for two purposes; first, for domestic use, and then for trade purposes?—Yes; but it is all the same water that is supplied; it is all supplied by the same set of mains.

5606. Is that so?—Yes; it is so supplied by the authorities of Leeds, I believe, for manufacturing and for domestic purposes.

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5607. Is it the fact that country gentlemen would object most to a large volume being taken for trade purposes?—I cannot answer for others; I can only express my own feelings. Water supply to these large populations is an obvious necessity for domestic purposes, and for manufacturing purposes it may be deemed almost a necessity, under certain limitations. But landed proprietors may, and I think they do naturally feel it is a hardship that the water should be abstracted from their part of the country and should be sent into other districts where large profits are realized from it.

5608. Do you think country gentlemen set much store upon the ornamental water in their estates?—Some of them do.

5609. Is it considered an advantage to have a fishing stream running through an estate?—Yes, a very great advantage.

5610. As a matter of utility, or as a matter of beauty?—As a matter of value; the value of an estate on sale by auction would be greater if it had a trout stream running through it.

5611. The increase would be greater than the value of the fish to be caught in the water?—Yes; it is like the value of a moor, or the game to be shot upon a moor in Scotland, and especially in these districts where persons are willing to give very large sums to obtain recreation within a reasonable distance.

5612. (*Mr. Harrison.*) Are manufactories springing up in the valley of the Wharfe?—Not very rapidly; there are some, but there is no great increase of population. There has been hardly any in Wharfedale; some manufactories have increased in size considerably, but there has not been much increase in number.

5613. Facility of obtaining coals has not encouraged them?—A railway has only been carried up the valley about two months, so that the facility for obtaining coal has not yet arisen.

5614. Has the pollution in the river near to Arthington, from which the Leeds supply of water is obtained, increased?—Yes; since I was a boy it has increased very much indeed; I have known the river for 35 years.

5615. Do you think the pollution is increasing?—Yes; I may mention that the town of Otley, until within the last few years, was drained into cesspools, but within the last three or four years they have connected their drainage directly with the river, and there is a vast discharge into it; the tanning matter and the sewage of the town generally is now cast directly into the river, which formerly was kept out in the cesspools. The cesspools used to be cleaned out, and the contents applied to the land. Paper manufacturers have also contaminated the water very much.

5616. Has that kind of pollution increased?—The manufacture of paper, until the alteration of the tariff upon paper, had increased very rapidly, but since that time it has been stationary.

5617. Do they use Esparto grass to any extent in the manufacture of paper?—I do not know; but they have used immense quantities of rags, gathered from Ireland and Germany; and all these are washed in the water, and then the refuse water is turned into the river immediately.

5618. (*Professor Way.*) Is your knowledge of Otley, Burley, and other towns sufficient to enable you to say whether there is any land in their neighbourhood upon which sewage might be placed by irrigation?—There is a rapid fall all down the Wharfe; it is a river that falls rapidly, and below each town there is land that might be used for that purpose, but then there comes this difficulty, that nobody wants it.

5619. If legislation were to prohibit sewage being passed into the river, do you think land could be found to which it could be applied?—There is no doubt of it, because the fall is so rapid that it could be applied without the necessity of pumping; by taking a sewer down, there would be fall enough down the valley. I have tried frequently the plan which I have heard referred to, that of irrigating land with sewage water, and I have always found that where you have to pump it, and place it on land by artificial means, the process is not successful, because the cost is too high; but when sewage could be placed without artificial means on land, that is to say, when the fall admits of the sewage running on by gravitation, then the process was very successful. The expense of lifting, of conveying water in carts, is considerable.

5620. You do not, I suppose, doubt that the sewage of these towns might be made applicable to agriculture if the question of expense did not interfere?—I have no doubt of it. Below the town of Otley there is some land that is particularly well adapted for it; the land is good, and it is a gravelly soil. In a very strong soil I doubt whether sewage will operate with any very great success, unless it is admirably drained; I mean where there is a stagnation of the water in the clays. My reason for asking to be heard here to-day was, that having seen the river Aire in its dry and most filthy state, and being independent of any influence, I thought it right that the Commissioners should know what my opinion was; and so strongly have I entertained the opinion I have expressed, that I communicated with the Home Secretary on the subject in 1865. He suggested that the local authorities of Thorpe Hall should be summoned, and should be required to take steps to remedy the evil. The local authorities, I believe, were represented by one individual, who unfortunately then became bankrupt; and besides that, it was not likely that one small township could undertake to deodorize the sewage of so large a town as Leeds. I also communicated what I felt upon this subject to the authorities of Leeds. I thought it my duty to do so; and I said, supposing the cholera breaks out in this district virulently, people will say, naturally, why did you not represent this to the authorities? I did so, and then I thought that the responsibility no longer rested upon my shoulders.

5621. You have attended to give evidence here to-day with the view, so far as you may influence the Government, that something may be done to remedy the state of things you have described in future?—Yes; without something being done in the lower portions of the borough of Leeds, I fear that at some day or other there will be a very serious outbreak of disease. I cannot describe to you the smell of the river below Leeds, but if the wind was in the east it would bring it up to the town. The gas arising from below was bubbling up through thick black stuff; large bubbles of air were coming up in different directions, and it was in truth so offensive that I was obliged to hold my handkerchief before my face. Some questions have been asked about cattle drinking water. I saw the cattle drinking the polluted water, although there runs through Thorpe Hall Pasture a brook which was uncontaminated. My impression was that the virulence of the disorder there, for it was the most virulent attack that we had in this district, arose from the cattle grazing near the water of the sewer and then drinking it; it is a very low lying district.

5622. Was it the fact or not that when the disease broke out there, the owners were prevented from removing their cattle?—Yes, they were, by order of the magistrates. We made an order, because it was feared that if the cattle were allowed to be spread over the district generally, we should have not only one place, but 50 places, visited by the disease.

5623. Did all the cattle perish on those meadows?—No, a great number of them were removed at night; the fences were broken through; but in some of the places to which the cattle were removed the disease broke out.

5624. Did a large number of cattle perish in Thorpe Hall Pasture?—Yes.

5625. How were the carcases disposed of; were they buried upon the spot where they died?—Yes, they were buried in quick lime. I saw the places where I was told they had been buried. I was not present when any of them were buried.

The witness withdrew.

Mr. JOHN EDWARD SMITH (Leeds) examined.

5626. (*Chairman.*) You are town clerk of the borough of Leeds?—Yes.

5627. Under what Acts is the borough of Leeds governed?—Under the Municipal Corporations Act, and under Local Acts—it is not under the Local Government Act.

5628. You have recently consolidated the Local Government by an Improvement Act?—Yes; in fact we have four Improvement Acts for the borough; the original Act was obtained in the year 1842, under which many improvements have been effected, and, among other things, the sewerage of the borough was improved. Under the next Act, the Improvement Act of 1848, a system of main sewerage was formed. Under that Act of 1848 a main sewer was authorized to be formed, and emptied into the river Aire.

5629. Opposite the meadows of which we have heard?—Precisely so, at the Thorpe Hall pastures; the place is called Knostrop.

5630. What are the principal trades carried on in the borough of Leeds?—The cloth trade is the original staple trade of Leeds; but we have added a great many more trades which have risen to very great importance. The iron trade in its various branches is now perhaps equal, if not superior to the cloth trade. In addition to that you have the leather trade in its various branches, from tanning up to the extreme preparation of the leather; and I am able to say, from information collected some time ago, that Leeds is the largest seat of the leather trade in the United Kingdom, London not excepted.

5631. About what number of hides annually can be tanned in Leeds?—From information which I have collected I have found that 1,700,000 hides and skins were prepared in the borough of Leeds in one year.

5632. What year was that?—It was the year 1864.

5633. Have you reason to believe that it is now less or more than that?—I have very good reason to believe that that trade is on the increase.

5634. Do you know what becomes of the considerable amount of refuse produced by tanning, spent bark, and refuse tan water?—From my own knowledge I can say that a great deal of that water is poured into a beck which we have, called Sheepscar Beck, which empties itself into the river Aire.

5635. In your recent Improvement Act have you any restrictive clauses which will prevent the pollution of the river by that tan refuse?—No; we obtained an Act of Parliament in the last session for the improvement of these becks, but that improvement simply consists of paving of the bottom and sides of the beck so as to assist the flow and prevent accumulation of refuse.

5636. That would be to prevent the becks accumulating the deposit, but to pass whatever deposit goes in on to the main river?—Yes.

5637. Leaving to chance its getting away from there?—Yes; in fact leaving the state of things in that respect as it was before.

5638. Is the river navigable up to and past Leeds?—Yes.

5639. Is it under the jurisdiction of a company or a board?—Yes; they are called, I believe, the undertakers of the Aire and Calder Navigation.

5640. Do they dredge the river opposite Leeds?—I believe so, that is as far as I can say.

5641. In Leeds you have an inspector of nuisances?—Yes.

5642. You have street scavengers?—Yes.

5643. Do you know whether your inspector of nuisances takes cognizance of floating carcases in the river Aire, opposite Leeds or below it?—He does not.

5644. Your scavengers have no authority to take out and bury those carcases?—No.

5645. Are you aware whether those carcases cause a nuisance during hot weather in summer?—I cannot say that I have had any complaint made to me upon that subject; I heard what Mr. Darwin stated; I heard that the condition of the river at Knostrop had been complained of.

5646. You do not, I suppose, take pleasant summer walks down by the banks of the river?—No, I am not in the habit of going down there.

5647. You have gasworks in Leeds?—Yes.

5648. Are they in the hands of the corporation, or of a company?—They are in the hands of two rival companies.

5649. You have waterworks in Leeds?—Yes.

5650. Do the waterworks belong to a company, or to the corporation?—They belong to the corporation; they originally belonged to a waterworks company, and they have been transferred to the corporation.

5651. When did the transfer take place?—In the year 1852.

5652. By agreement and purchase?—By agreement and purchase confirmed by Act of Parliament.

5653. Then at present the water supply is in the hands of the corporation?—Yes.

5654. Is the present supply considered a satisfactory supply, as regards volume and quality?—It cannot be said to be considered a satisfactory supply, for we are going to Parliament in the next session for a larger and a purer supply of water.

5655. I assume that we shall have that scheme stated to us by one of your engineers?—Not the details, but general information respecting it can be afforded. We expect to be opposed on the scheme.

5656. You are aware that by the tenor of our instructions we are authorized and expected to inquire into water supply?—Yes.

5657. But you as legal adviser of the corporation will necessarily stand in the gap and will protect the corporation from any undue exposure of that respecting which you will have to contend over again in another place?—Just so.

5658. Then if we ask either you or any of the officials questions which you think ought not to be answered, an intimation to that effect will stop us. Have you commenced to put in operation the clauses which you obtained in your last Improvement Act with regard to your Local Government?—Yes; under that Act we have amalgamated the powers of the highway surveyors which were previously vested in different boards in various townships; the highways now are vested in the corporation, and will be repaired out of a general rate extending over the whole of the borough.

5659. Do you know whether there are any undedicated private streets which are not sewered or paved?—Yes, many in the borough yet remain to be done; we are going on fast with the work, but yet many remain to be done.

5660. Leeds, I assume, has been a growing town—it has grown rapidly?—Very much so.

5661. Is it growing now; is much building going on?—I should say that it is growing very rapidly.

5662. The town council have submitted to them for approval the plans of buildings before they are erected?—Yes; we have enlarged powers as to those matters under the new Improvement Act, to which I have referred.

5663. Have you a local building surveyor appointed in the borough of Leeds?—Yes.

5664. It is his duty to inspect and to see that the buildings are in conformity with your byelaws or regulations?—Yes, he is called the buildings inspector.

5665. How long have you had such an officer?—Several years, I cannot speak exactly to the time.

5666. Have you a medical officer of health?—Yes.

5667. How long has he been appointed?—He was appointed under the new Improvement Act to which I have referred; he has only been appointed two or three months.

5668. Is the appointment considered a temporary, or annual appointment, or a permanent appointment?—A permanent appointment.

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5669. Have any complaints to your knowledge been brought before the town council as to the polluted state of becks and streams flowing into and through Leeds?—Yes, the polluted state of the becks, including the Sheepscar Beck to which I have referred, led to the Act of Parliament which was passed last session for their improvement; it led to the subject being brought before the council.

5670. The pollutions were sufficiently obnoxious to induce the council to be at the cost and risk of a New Improvement Bill?—Yes. The Act to which I am referring for the improvement of the becks, was a separate Act from the General Improvement Act; we procured two Acts.

5671. Are there manufactories situated upon these becks and streams beyond the boundaries of the borough of Leeds?—Yes, but not to any great extent; probably one or two.

5672. Is the river Aire polluted above the town of Leeds, by pollution from towns and manufactories?—I should say so. Within my recollection the river above the town seems very much to have deteriorated.

5673. There are towns situated upon the Aire above Leeds?—Yes.

5674. In the event of Leeds carrying out its improvements to the utmost, and seeking to purify the river, would it result as a matter of course that the other towns would follow so good an example?—No, I think not, without the same compulsion being put upon them as might be put upon Leeds.

5675. Then do you consider that the operation of any restrictive clauses against river pollution from either solids or fluids should be commensurate with the river's area rather than be confined to individual and separate towns?—I do.

5676. What are the clauses in your last improvement Act which refer to the improvement of the becks in the borough of Leeds?—I unfortunately have not the Act to which I refer. I will hand it in to you.

5677. Will the work of paving the becks at the bottom and the sides be done at the cost of the riparian owners, or out of a general rate to be levied upon property in the district, or out of the borough rate?—It will be out of the improvement rate.

5678. Will that improvement rate be levied upon the whole borough?—No, but upon the townships in which the becks are situated.

5679. Then you have powers to levy district rates?—Yes.

5680. In addition to powers which enable you to carry out works, have you power to prevent the abusing of the rivers, or to prosecute persons who abuse them?—No.

5681. Does the Act give you the power to prevent sewage or effete matter from privies or cesspools being thrown in?—No. We have powers already for that purpose under the Nuisances Removal Act; but it is an objection to those powers, that you have to state that the premises are a nuisance or injurious to health, and you have to proceed against the persons who cause that nuisance. Of course in some cases it is very difficult to arrive at the real wrong-doers, as there may be many.

5682. You say that there are two companies making gas?—Yes.

5683. Are their works situated within the populous parts of the borough, or are they in the suburban parts?—They are within the populous parts of the borough.

5684. The works are built round?—Yes.

5685. Have you any power to interfere with the accumulation of refuse upon their premises?—Only under the general powers given by the General Act of Parliament.

5686. Have you ever any complaints against the accumulation of refuse at the gasworks?—No, I never heard any.

5687. Have you had the question of sewage utilization brought before you?—It has never been formally brought before the council; it has been considered once or twice by the streets and sewerage committee of the council, and they have always found very great difficulty in dealing with it.

5688. Are waterclosets general throughout Leeds in the dwellings of the working classes or not?—No, they are not general in the dwellings of the working classes.

5689. In the hotels, and first class houses, and large offices, I assume that you have waterclosets?—They are pretty general there.

5690. You have waterclosets throughout this town hall?—Yes.

5691. Do the borough authorities scavenge the town, do they take charge of emptying cesspools and cesspits of private houses?—We do within certain parts of the borough, within the municipal townships; namely, Leeds, Hunslet, and Holbeck.

5692. Was that restriction established because you had not jurisdiction over the other townships?—No, simply because of the difficulty of going into the out townships, on account of the great area of this borough.

5693. Is it a profitable or a losing transaction?—I am sorry to say that with us it is a losing transaction.

5694. I suppose that you furnish your accounts annually?—Yes.

5695. Have you a debtor and creditor account with regard to the emptying of cesspools or ashpits?—Yes.

5696. Can you show us the amount of contents removed, the cost of removal, and the profit, if any, from the sale of refuse?—No, we let it by contract.

5697. I suppose that the contractor can give us those details?—I do not suppose that he can; I believe that the inspector of nuisances will be able to give you information upon that point.

5698. Has the question ever been discussed in the town council as to the utility of introducing waterclosets as a substitute for privies?—No, it has not been formally discussed.

5699. Your medical officer of health will perhaps be able to give us the local mortality of Leeds for the last eight or 10 years?—He probably will have the returns by him; he has only just been appointed.

5700. Have you the mortality returns?—No, but I think that we can furnish you from the Nusiance Office with some returns as to the mortality of Leeds.

5701. Have you any clauses in your new Act restricting smoke?—We have clauses in the new Act as to smoke, but they are substantially the same as those which were in one of our previous Acts, except a little modification for the benefit of the iron trade and the dyeing trade.

5702. An attempt I think was made by a portion of the council to get more stringent clauses which the council as a body neither opposed nor defended; did those clauses stand or fall?—An attempt was made by some of the inhabitants of the borough who presented a petition to that effect when the bill was passing, and the clauses were obtained, with the slight modification to which I have referred, for the protection of the iron trade and the dyeing trade.

5703. Have you attempted to put in force any of the clauses?—Yes.

5704. Have you a smoke inspector?—We have a smoke inspector, and we regularly put in force these provisions. One of the modifications to which I have referred is that no means for the consumption of smoke created by processes either of the dyeing or the iron trade are to be deemed practicable unless it is proved that the same have been successfully applied in similar processes in actual operation, and have been used for 12 months in similar processes.

5705. With regard to the steel trade, I think that one of your aldermen, namely, Aldermen Kitson, is putting up new works in which the process known as Mr. Seaman's process by gas is to be tried?—So I understand.

The witness withdrew.

Mr. Thomas Fenwick (Leeds) examined.

5706. (*Chairman.*) Are you a surveyor and engineer?—Yes.

5707. Have you had considerable practice as a sanitary engineer?—I have.

5708. For how many years?—For about 16 years or upwards.

5709. I think that a good many years ago you assisted a Government inspector in the north of England in some inquiries into several large towns there?—Yes; I had the pleasure and advantage of assisting you in inquiries which you made at Alnwick, Berwick, Morpeth, and North Shields, and other places.

5710. And Gateshead?—Yes.

5711. And Newcastle?—Yes.

5712. Since that period you have been borough engineer for North Shields?—I was borough engineer for Tynemouth and North Shields from 1851 to 1861; I then came to reside in Leeds.

5713. You have had, I believe, considerable experience since your residence in Leeds in devising and carrying out systems of land drainage?—My partner, Mr. Martin, and I are the engineers for the Aire-dale Drainage Commissioners. Previously to entering upon that subject I will lay before you a plan showing the rivers Aire and Wharfe. This plan shows the Wharfe and its tributaries, and the Aire and its tributaries, till it joins the Ouse. The Aire here (*pointing to the plan*) runs into the Ouse, and they together form the Humber. On this plan I have marked all the mill weirs and other dams which are placed on the river Aire, and I have a description of them, with their distances from the junction with the Ouse, and the height of each weir above the sea. (*The witness read two papers, which will be found printed at the end of his evidence.*)

5714. Have you had an opportunity of gauging the river at any special point, and if so under what conditions, and on what occasion?—I had occasion to observe the rise of the floods with reference to the cuts proposed to be made within the district, and I took some observations at different points. The highest flood that I have observed at any time since 1861 showed a flow over the weir at Stock Bridge of 7,670,000 cubic feet in an hour. I have heard of occasional floods very much greater than that; one gentleman who has taken some trouble in inquiring into the rainfall of that district has stated that a quantity equal to about five times that amount has been known to pass down. I cannot say how far he may be correct; but I have no doubt that floods very much larger than the one alluded to have passed down the river, although this is the greatest which I have seen, and it has been considered a very high one.

5715. (*Mr. Harrison.*) What is the date of that flood?—November 1861.

5716. (*Chairman.*) Do you know by any gauging, or observation, what was the dry weather flow at that point?—Yes; the minimum flow which I have observed was 67,000 cubic feet in the hour.

5717. Was that after continued dry weather, or very dry weather?—In ordinary dry weather; after perhaps a month or six weeks of fair weather. The high flood was in November 1861, and the summer flow which I observed was in 1862. This is the Parliamentary plan of the district between Leeds and Skipton, and on it I have marked the several works (*producing the same*). This weir (*pointing to the plan*) has been removed, and the surface water has been reduced about four feet. This work near Elam (*pointing to the plan*) is now in course of construction. There was a great accumulation of gravel at Holden Beck, which was brought down the stream in heavy floods, and caused the water in the Aire to be dammed back; that has been taken out, and we have consequently been enabled to improve the fall as far as here. The most important thing was to get the surface water reduced, so as not to have the lands flooded in ordinary times. All the parts tinted blue used to be covered at every ordinary flood; in some parts the land lies so low that necessarily when floods come the water is dammed up in the drains, and lies upon a certain portion of the land; yet as soon as the river subsides that water flows off, and none of it continues to lie upon the land as it formerly did. Previously to 1861, whenever a great flood came upon the land in this way it was many weeks before it went off. At several places along the valley the ordinary surface water was standing so high between the artificial flood banks, that a great deal of the land adjoining it was below the level of the river water. At this place (*pointing to the plan*) lead washings and accumulations, of gravel have had to be taken out. Generally throughout the district the river is lowered about four feet. At one place we lowered the water nearly seven feet (*pointing out the same*). Here is some land which previously to the works being commenced had an annual value of only 3*s.* an acre, and since that work has been made the flood has never overflowed the land as it did formerly. A portion of the land (*pointing out the same*) is now under tillage. This section (*producing the same*) shows the fall which has been obtained by the works. The upper blue line is the ordinary level of the water previously to the works being commenced; the lower line is now the ordinary level of surface water, and the red line is the former flood line; and it shows that in many parts of the valley the ordinary surface water was actually above the level of the land, and when a flood came it spread over to the extent which is shown on the plan.

5718. (*Professor Way.*) How far do you imagine that that alteration affects the drainage of the land?—It does not affect the drainage of the land much beyond what is coloured blue. The land rises steeply from this point (*pointing to the plan*) so that beyond this the valley is very well drained. The cause of the stoppage here (*pointing to the plan*) was principally the gravel, which was brought down Eastburn beck by floods. At this point (*pointing out the same*) there had been an accumulation of at least 8 feet. and by making this cut, there was an immediate relief to the extent of nearly 7 feet. We have found by experience that it does not pay the Commissioners to make land by filling up the old channel. They convey the bed of the river to the adjoining proprietor, and he or his tenants gradually make land of it. I have no doubt that in course of time the whole of the abandoned channel will be made into useful land.

5719. (*Mr. Harrison.*) When did you obtain that Act of Parliament?—In 1861.

5720. What is the area of the land which was subject to flooding?—About 2,300 acres.

5721. What is the fall in the river?—Within the drainage district it is about 3 feet per mile. The height above the sea at Stock Bridge, near Keighley, is 270 feet, and at the upper end of the district it is 309 feet; there is 39 feet rise in that distance, which is about 10 miles in a straight line, and about 14 miles by the river; 12½ miles by the improved river course. From Inghey Bridge to Airton Mill, a distance of eight miles and nearly a-half, the fall is 216 feet—the land beyond that point rises rapidly.

5722. What is the fall per mile from Keighley downwards?—For a distance of 10 miles downwards there is a fall of 95 feet.

5723. So that the district which you have improved was a comparatively flat district?—Yes; lying between Keighley and a point above Skipton.

5724. The part above Skipton falling very rapidly?—Yes.

5725. And the part below Keighley falling very rapidly?—Yes. Immediately below our district there is a mill weir called Castleford Mill Weir, and it dams the water back, and causes a good deal of the injury of which a previous witness, Mr. Ferrand, spoke.

5726. I presume that it was the peculiarity of the district, the fact of its being so very level, as compared with that above or below, which determined the limits of the improvement?—It was.

5727. Has the improvement made had the effect mentioned by Mr. Ferrand, namely, of expediting flood

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waters and flooding land below Keighley?—It causes the water to pass off much more rapidly than it did before, but the effect, so far as I have been able to judge, is that instead of causing the lands below to be more flooded, it prevents the water from rising so high as it formerly did. In consequence of the increased fall the water passes away much more rapidly. In this district between Keighley and Skipton it has not time to accumulate as it formerly did. Previously to the cuts being made, the water was impounded during floods, behind the artificial banks on both sides of the river, and when heavy rains continued after these reservoirs were full, the volume of water due to the rainfall was increased by the escape of that which had been impounded during the early part of the flood; the accumulated water behind the banks found its way out through numerous cloughs into the river, and the effect was that the lands below were subject to floods, which now I think they have got rid of to a certain extent.

5728. Then you do not agree with Mr. Ferrand in that respect?—I do not.

5729. In making those alterations, what arrangement did you make as to the boundary?—The Act specified a district between a certain point below Stock Bridge and Ingbey Bridge above Skipton, without regard to the parishes; it was a district which was referenced in the Parliamentary plans, and the commissioners have power over the whole of that district; the district practically is confined to the portion of the land which was affected by floods.

5730. If you make a short cut so as to shorten the length of the river, the boundary of the parish remains the same?—Yes.

5731. Those streams which you mentioned as bringing down a large quantity of gravel will continue to do so unless you prevent it; do you see your way to preventing it?—Yes; we have constructed lodges for the purpose of intercepting the gravel; large bodies of gravel are brought down by these streams now as before. We inspected the course of some of these tributaries, and we found that the expense of intercepting the gravel above would be very enormous, and that the relief so obtained would be only temporary, and we resolved upon forming those lodges within our own district, to be cleaned out when required; we have never yet had occasion to clean them out, but it will require ultimately to be done. Three gravel traps have been formed on Eastburn beck.

5732. Of what extent are they?—About an acre and a half, or, including land for spoil, about three acres.

5733. Of course it destroys that quantity of land for the time being?—Yes, but they are formed in the channel of the beck itself.

5734. Is it the case that the proprietors of land who were the prime movers in this improvement have experienced the disadvantage of allowing the river to be filled up by the gravel naturally brought down by these becks to such an extent that they have made traps to prevent the gravel in future being carried into the river?—The commissioners made those traps; they bought of the owner the land which was necessary to make them, and these lodges remain the property of the commissioners. The commissioners appointed under the Act were 18 in number. The number of commissioners in office is not to be less than 16 nor to exceed 21.

5735. You have heard from Mr. Ferrand that the inhabitants of Keighley throw largely their ashes and refuse into the beck?—Yes.

5736. And that those ashes collect in the bed of the river Aire, and have necessarily raised the bed?—Yes, that is quite correct, and the same practice has been pursued throughout the district. We have complained about its being done, but the mill-owners near to Keighley and at Sutton have continued the practice.

5737. The effect would be to re-form artificially that dam which you have removed for the improvement above?—Yes; they have partially caused the obstructions which we have had to remove at the expense of the commissioners.

5738. The process now going on in the lower part of the river at Keighley, and other places, of raising the bed of the river by cinders and other matters, is something similar to the formation of gravel beds which you have been at a considerable expense to prevent in the upper part of the river?—It is quite a similar thing though the injury perhaps will not be to the same extent.

5739. Still that is merely a question of extent?—Yes, it is the same mischief, and it is a thing which ought to be put a stop to. We found that some mill-owners had been in the habit of throwing their refuse into the becks which came into the river, and were the cause of mischief, and we endeavoured to put a stop to it; but we found that they were beyond the limits of the drainage district, and we could not touch them. It would be most desirable to have some power to prevent such things being done, for they inflict injury upon the river and upon all who have land adjoining it. The improvement in many parts of the valley has been very striking; marshy parts have been improved, and within a few years will command a high rental. But the benefits which have been conferred by the works ought not to be entirely measured by that, because it is a fact that from year to year the valley was getting rapidly worse, in fact in a few years the marsh land, which existed in portions only of the district, would have extended throughout the whole valley. The landowners were satisfied that the land was becoming daily worse, and in a short time they would have had very many acres which would have been comparatively worthless.

5740. (*Chairman.*) Do you know any other districts of Yorkshire where similar improvements might be made with corresponding benefits?—I could not specify any places. There are many districts in Yorkshire where low lands are flooded.

5741. What is the name of the district where the railway to Newcastle is occasionally put under water?—That is somewhere near Darlington—at Morden Carrs; works are now being executed there which I think will have the effect of relieving it altogether.

5742. Is that by a commission or under an Act of Parliament?—I think not; I think that some of the principal landowners, Lord Eldon and others, are carrying the work out.

5743. There is another district on the London and North-western Railway between Stafford and Crewe?—I do not know that.

5744. (*Mr. Harrison.*) Do you agree with Mr. Ferrand that it would have been desirable to have had an improvement of the river carried out throughout its entire length, and that it should not have been confined to a portion?—Perhaps it would have been well to have had the powers of the commissioners extended over a larger district, but there was not the same inducement for them to enter into the improvement of the lands below as there was in this special district.

5745. There was a large area of land in this district which was subject to floods, and there was not a similar area below, so that it was not equally the interest of riparian owners below to join with you?—Just so. It may have been that if the owners below had joined these gentlemen, whose names are in this Act, a larger district might have been included in this Act. But the improvement of the valley is not confined to the improvement of the land; it has also had a beneficial effect upon the health of the district.

5746. How can you prove that?—I have a letter from Dr. McNab who has a large practice in that district, and he writes as follows (*reading the same*): This improvement has not been merely a landowner's question, but has been productive of important sanitary results, and it has been argued by some of the landowners that the cost of the works ought partly to have been defrayed by a rate upon the inhabitants on account of the improvement as a sanitary measure.

5747. (*Chairman.*) As well as by a rate upon the land?—Yes; I may also observe that where the new cuts have been made the river has been very much shortened.

5748. (*Mr. Harrison.*) You heard Mr. Ferrand's objection that by the improvements you had taken away so many miles of the river?—Yes; it has given landowners an opportunity of making land of what was before river, and has shortened the course of the river.

5749. How do you conceive that that in any way can injure the millowners below?—I do not conceive it to be possible that they can prove any damage.

5750. (*Chairman.*). You have not made the water less in volume?—Certainly not.

5751. (*Professor Way.*) Mr. Ferrand spoke as if you had diverted the water?—That is not so, it is carried down by the new cuts more quickly than before.

5752. He says that its flow is not so regular, that it was formerly kept back by the tortuous course and that the water was therefore diffused more equally?—I do not think that there is any objection in that respect to what has been done.

5753. (*Mr. Harrison.*) I presume that if what was called the Lake district was covered with water for several months in the year, it was a large reservoir for the benefit of the mills below, and gave off the water quietly for months and months?—It did.

5754. So far, what has been done may have injured the water power, but there was certainly no excuse for keeping up that state of things?—The public certainly had no interest in allowing such a state of things to remain.—I have some statistics of rainfall for which I am indebted to Mr. Henry Cowper Marshall, of Derwent Island, to the Rev. Mr. Daniell, of Broughton, and to Mr. Brown, of Skipton. The tables show that in the summer months, from March to September, the per-centage of the total rainfall in Leeds is 60 per cent. and in the five winter months 40 per cent., whereas at Keswick the reverse is the case; in the summer months it is 47, while in the winter months it is nearly 53 per cent. I have here the rainfall for 20 years at Holbeck giving an average of 21·91 inches; at Keswick it is 58·38 inches and at Seathwaite it is 139 inches. The average of five years at Settle is 40·64 inches; at Arncliffe in Wharfdale it is 58·22 inches, and at Otley it is 27·43 inches. I have the rainfall for 1865 at several places, which will afford a comparison between the Aire and the Wharfe valleys.

5755. By what means have you arrived at the gaugings of the minimum and the maximum flow of water?—From observations on the Stock Bridge weir.

5756. When there was a flood was there a good fall from the upper to the lower side of the weir?—Yes, there was a sufficient fall—probably 18 inches. When there was 10 feet rise in the river, in the flat portions of the valley there would be a diminution of about 3 feet 3 inches in the fall over the weir.

5757. How many miles above is that flat?—A short distance above there is one of the flat places—about two miles above. In a flood which rose 2 feet 3 inches on the weir at Stock Bridge, there would be a rise of 7 feet 6 inches in the river 2 miles higher up. At Carlton Bridge, near Skipton, the difference of level was 10 feet 3 inches during the same flood in November 1861. I have a section showing the flood level between Keighley and Skipton, and in some other parts of the valley a similar difference in level is shown.

5758. What is the minimum?—The minimum over the weir was about an inch and a quarter.

5759. What is the length of the weir?—About 170 feet.

5760. (*Chairman.*) Have you gone through your memoranda?—I have tables here of the rainfall which I will hand in to you.

5761. Are there any other facts which you would wish to bring before the Commission?—Some observations have been made about the state of the water below Leeds. There are some pastures just below here called the Thorpe Hall pastures, and on them there happened to be a great deal of the cattle plague last year. I do not know whether the disease might have been aggravated or induced by the state of the water, but certainly at that place river water was very unfit for cattle to drink.

5762. And the atmosphere was very foul?—Yes, for a considerable distance below that spot.

5763. And the land is very flat, and liable to be flooded?—Yes.

5764. (*Mr. Harrison.*) How far is Thorpe Hall meadow below the outfall of the sewer?—It is immediately below Leeds.

5765. Was the cattle plague severe immediately at the mouth of the sewer?—It was very bad on the Thorpe Hall pastures, it was almost like a plague spot; a cordon was put round about there, and the cattle were confined to it.

5766. Are the Thorpe Hall pastures conveniently situated, and suitable for sewage irrigation?—They might be so treated.

5767. (*Professor Way.*) In the upper district of the river is there land suitable for sewage irrigation near to the different towns?—The meadows which were formerly covered by these floods might to a certain extent be irrigated by the sewage from the villages.

5768. Have you paid any attention to the question of sewage irrigation?—I have paid some attention to it. I made an experiment on a small scale near North Shields. I built a sewage tank there for the Duke of Northumberland, to receive the sewage from a small village, and my experience of sewage irrigation is that where it has been tried and has failed, and where, as in the case of farmers, an outcry has been made against it, the failure has perhaps been more attributable to the want of proper dilution than to anything else. In this case there was a stream of water running, which flowed into the tank along with the sewage. I had the tank so constructed that the first compartment received the solid matter, and after depositing there the liquid portion flowed into a settling well, from which the water flowed down comparatively pure, and portions of the land were irrigated from this source by the farmers, but they were neglectful of the advantage which was open to them—they did not carry it out to any great extent—but upon the small piece of land which they did irrigate the benefit was at once apparent from the increase of grass, and there they might have got two crops for one in any other part of the land. The proper disposal of the sewage of towns is in my opinion a very difficult question, and one not satisfactorily answered yet. That, and the supply of water to towns, are two of the most important questions of the day.

5769. (*Mr. Harrison.*) Is the refuse from the lead mines found to be a nuisance at all?—Not further, I think, than causing a discoloration of the river below Cononley.

5770. (*Professor Way.*) Do they work them now?—I think that they do to a certain extent. (*The witness delivered in certain plans.*)

The witness withdrew.

PAPER read and put in by THOMAS FENWICK, Esq., C.E. (referred to supra Question 5713).

The Airedale Drainage Act, 1861, embraces a district in the valley of the river Aire, extending from Inghey Bridge, about three miles west of Skipton, to a short distance below Stock Bridge, near Keighley.

This district suffered greatly from frequent inundations arising from natural anp artificial obstructions in the bed of the river, which penned up the water to such an extent that a large tract of land on both sides of the river had become

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little better than a marsh, many acres of which were contiuually submerged, even when the river was at its lowest summer level.

To remedy this state of things the principal landowners in the valley applied for and obtained the Act of 1861, which enabled them to straighten the course of the river, remove obstructions in the channel (consisting principally of a mill weir at Stock Bridge, and large accumulations of gravel and mill refuse brought down by the various becks in times of flood and deposited in the river channel), raise flood banks and otherwise improve the river course.

Power was also given by the Act to make all necessary drainage works and improve existing drains within the district, and to determine which (if any) should be public drains to be made and maintained by the Commissioners, and which should be private drains.

The Commissioners appointed under the Act were 18 in number, namely: His Grace the Duke of Devonshire, Sir Richard Tufton, Baronet; Admiral Russell Eliott, Sir Charles R. Tempest, Baronet; George Lane Fox, Matthew Wilson, John Robert Tennant, George Drewry, Thomas Kell, Frederick Greenwood, John Benson Sedgwick, Stephen Eddy, John Robinson, John Greenwood Sugden, Abraham Maud, Binns Smith, James Smith, and James Slingsby. The number of Commissioners in office not to be less than 16 nor to exceed 21.

Immediately after the passing of the Act, measures were adopted for carrying it into effect, and the principal works authorized have now been executed.

Between Stock Bridge (near Keighley) and Skipton the ordinary surface water has been lowered on an average throughout of about 4 feet. At one part of the river below Kildwick Bridge it has been lowered 6 feet 6 inches, and a large tract of land in that locality, which was comparatively worthless, has now become valuable land, and is partly under tillage. Portions of the low lands are yet occasionally laid under water in high floods, but the water passes off as soon as the river subsides, and does not remain on the land as it formerly did for weeks together. Many acres of land which before the passing of the Act, was not worth more than 3*s.* per acre to rent is now excellent grazing land, and in a few years will be worth from 2*l.* to 3*l.* per acre.

The improvement manifested throughout the valley in so short a time is very striking and satisfactory; and although the cost of obtaining the Act was exceedingly heavy, owing to the unexpected opposition it met with before the Committee of the House of Commons, the permanent improvement in the land, it is believed, will give a profitable return upon the outlay; but the benefits derived from the works are not to be measured only by the actual improvement which has taken place. The lower parts of the valley were rapidly assuming a marshy character and would in a short time have been much more seriously depreciated in value.

The total expenditure will be about 25,000*l.*, and the area of the district directly benefited by the works is 2,300 acres, so that the average cost of the improvement is about 11*l.* per acre.

The money has been borrowed under the authority of the Act of Parliament, and rates are levied on the *land* within the district to pay off capital and interest in about 20 years.

But another important feature in this case is the removal of miasma from the marshy districts about Kildwick, Cross Hills, Cononley, &c., and its effect upon the health of the inhabitants of those villages.

On this subject we have a communication from Dr. Macnab, who has resided 12 years at Cross Hills (about midway between Skiptonand Keighley), and has an extensive practice in that district, he writes as follows:

"The various villages in close proximity to the Aire—
"Bradley, Cononley, Farnhill, Kildwick, Cross Hills, and
"Steeton—with most of their inhabitants are well known
"to me. I have no hesitation in saying, to whatever
"cause we may attribute it, the state of these villagesin a
"sanitary point of view has greatly improved within the
"last few years. Whereas, in days gone by, the first five
"villages were considered the *habitat* of typhus fever.
"during the last two years there has not been a case of
"fever in one, except in Cononley last winter, when one
"whole family suffered, and the disease was caught at
"Idle or Apperley Bridge (villages a few miles distant).
"Formerly also bronchitis and rheumatism were much
"more frequent here than they have been lately.

"It is perhaps unfair to give the Airedale Drainage all
"the credit of this very obvious improvement, knowing as
"we do that in localities this type of disease changes. I
"think, however, we are quite justified in giving to the
"drainage a fair share of it all. I remember well, before
"the drainage, almost the whole valley from Keighley up
"to Skipton, more especially that part from Kildwick to
"Cononley and upwards, was generally covered with
"water for four or five winter months. We used to call
"it the "Lake district." A part of the Skipton Road
"between Kildwick and Cononley, was frequently covered
"with water up to the horses' girths. Now, close by the
"roadside, at what was the worst place, stand a mill and
"several cottages.

"In the months of March and April, when the flooded
"land began to re-appear, there was a dreadful smell
"occasioned by the offensive alluvial matter, the rotting
"of grass, &c. This, I have no doubt, was one cause of
"fever, poisoning, as it did, the atmosphere. The extreme
"dampness of the atmosphere, the mists and fogs arising
"from such a breadth of superficially diffused water, were,
"I think, the cause, to some extent, of bronchitis, rheu-
"matism, &c."

The Airedale Drainage has, therefore, nor been merely a landowners' question, but has been productive of important sanitary results; and it has been argued that the cost of the works ought to have been partly defrayed by a rate levied upon the inhabitants of this part of the valley as well as upon the land actually relieved from flood.

Where new cuts have been made the course of the river has been materially shortened. We are at present making a new cut a short distance above Keighley. The channel thus formed will be only 217 yards in length, and will occupy an acre and a quarter of ground in substitution of the old river course, 1,760 yards long, occupying an area of more than seven acres. The first cut that was made is below Silsden Bridge. It is 300 yards in length and occupies an acre and an half. The abandoned portion of the river course at this place was 1,144 yards long, having an area of 4¾ acres; other cuts have been made which have shortened the river course, but not to such an extent, and we do not find it pay to make new land of the abandoned channel by leading spoil to fill it up. The principal advantage lies in obtaining an increased fall by shortening the distance.

(Signed) Thos. Fenwick.

Paper read and put in by Thomas Fenwick, Esq., C.E. (referred to supra Question 5713.)

The river Aire takes its rise below Malham Tarn about five miles east of Settle, and in its course south-eastward to Leeds is fed by the following streams, namely:

Otterburn beck, Broughton beck.
Carlton beck, through the village of Carlton.
Eller beck, bearing with it the sewage and mill waste of Skipton.
Bradley beck.
Cononley beck, charged with the lead-washings from the Duke of Devonshire's lead mines near Cononley.
Eastborne beck, down which are carried immense quantities of gravel besides refuse thrown in from the mills at Sutton.
Steeton and Silsden becks, which drain the villages so named.
Holden beck.
The river Worth into which is discharged the sewage of Keighley and the refuse of numerous mills in the Haworth valley.
The Bradford beck, which is the common sewer of Bradford and Shipley with their numerous mills and manufactories.
And the no less filthy streams which flow into it through the town of Leeds.

Manufactories have largely increased in the valley of the Aire and the river near Leeds has consequently assumed all the foul characteristics of a great sewer. Yet so lately as 1841 the town obtained its water supply by pumping from the river at Leeds bridge.

Until within the last few years, above Shipley (where the sewage from Bradford falls into it) the stream was comparatively pure, but the increase of manufactories at Keighley, Skipton, and other places, has quite changed its character in that respect.

Four years ago there was not much pollution in the river below Skipton until it reached Cononley beck where it became partially whitened by the lead-washings carried down that stream, but the recent establishment of dyeworks at Skipton and the extension of the sewerage works in that town have destroyed its comparative purity. In dry weather the smell from these causes is quite perceptible two miles below Skipton.

Below Bradford the river is exceedingly foul and for several miles below Leeds the smell from it is most offensive.

At Castleford it is joined by the river Calder highly charged with the sewage of Wakefield, Dewsbury, Elland, &c., and the united streams flow sluggishly on towards the Humber full of impurity.

The following is a list of the weirs upon the river Aire, their distances from its junction with the Ouse a few miles above Goole, and their heights above the sea, taken approximately from the Ordnance Levels.

Distance from junction with the river Ouse in miles.		Height above the sea in feet.
15¼	Haddlesey dam (belonging to the Aire and Calder Navigation Company)	17
19¾	Beaghall dam	21
23½	Knottingley mill weir	30
29½	Castleford mill weir	39
34	Fleet mills, Woodlesford	47
37¼	Dam at Thorpe Stapleton	60
40½	Thwaite mills, Hunslet	67
41½	Hunslet old mill	74
42½	Nether mills, Leeds	80
43¼	King's mills, Leeds	87
45	Armley mill	96
46	Kirkstall mill	105
47½	Newlay mill	129
48¼	Ross mill, Bramley	137
49¾	Calverley mill weir	146
53½	Esholt Hall dam	175
54¼	Upper Esholt mill	182
55	Buck mill	190
56¼	Baildon mill, Shipley	198
57	Dixon mill	206
57½	Hirst mill	213
58½	New Hirst mill	220
60½	Bingley mill	248
61½	Castlefield mill weir	259
63¾	Stock Bridge (weir removed)	270
68¼	Silsden Bridge (river bed now lowered)	280
72	Cononley Bridge (river bed now lowered)	292
75	Carlton Bridge	296
77½	Inghey Bridge	309
80½	Gargrave mill weir	360
83¼	Bell Busk mill weir	440
85½	Aireton mill weir	525
90	Malham	

The area within the watershed of the Aire is about as follows:

Westward of Skipton	53,760	acres.
Between Skipton and Keighley	38,400	„
Between Keighley and Leeds	96,720	„
Total westward of Leeds	188,880	„

Half an inch of rainfall within the watershed above Keighley (92,160 acres) would be 167,270,400 cubic feet.

The greatest quantity of water which I have observed passing Stock Bridge near Keighley during the highest flood was 7,670,000 cubic feet per hour, equal to about 1,000 cubic feet per 12 hours per acre of watershed, but I have heard of occasional floods passing five times that volume of water.

In ordinarily dry weather I have observed not more than about 67,000 cubic feet flowing during the same period.

Population within the watershed of Airedale westward of and including Leeds, according to the census of 1861, 482,475.

Population within the watershed of Wharfedale above Arthington (where Leeds obtains its water supply), according, to the census of 1861, 30,200

This water is fouled not only by the resident population of 30,000, but by the sewage from the invalid establishments at Ben Rhydding and Ilkley, and by the lead-washings from the mines in the vicinity of Burnsall.

Population within the Watershed of the Aire, Westward of Leeds.

Kirkby, Malhamdale, Hanlith, Calton, Airton Otterburn	1,211
Gargrave, Winterburn, Eshton, Coniston, Bank Newton	1,391
Hetton and Bilstone (in Burnsall)	164
Skipton-town	4,503
Eastby, Embsay, and Thoralby	1,334
Broughton	577
Marton in Craven, East and West Marton	256
Thornton in Craven, Earby Kelbrooke	2,112
Salterforth in Barnoldswick	424
Carried forward	11,972
Brought forward	11,972
Carlton in Craven, Dale End or Town. Lothersdale,	2385
Kildwick parish, Cononley, Bradleys, Silsden Steeton with Eastburn, Sutton	10,893
Keighley, Haworth, Oakerworth, Braithwaite (parish)	18,819
Bingley, East Morton, Baildon, Hawksworth	15,367
Guiseley, Yeadon, Rawdon, Horsforth, Little London	19,284
Bradford parish	156,053
Calverley parish	28,563
Gildersome	2,701
Drighlington, Churwell	8,873
Leeds	207,565
Total	482,475

Population within the Watershed of the Wharfe.

Arncliffe	140
Deepdale, Foccup, Cray, Kirkgill, Buckden, Litton, Hawkswick	483
Kettlewell	1,141
Starbotton	161
Burnsall, Cracoe, Appletreewick	1,414
Kilnsey, Conistone, Bordley, Thorpe	348
Linton	1,911
Grassington, Hebden	2,599
Barden, Drebley, Bolton	483
Draughton, Hazlewood, Addingham	3,514
Blubberhouses, Fewston, Timble	1,660
Weston, Denton, Askwith	958
Ilkley	1,407
Middleton, Nesfield	358
Otley	13,040
Burley, Menston, Poole, Leathley, Castley, Bramhope	584
Total	30,201

Rainfall.

At Holbeck, Leeds, (the gauge being 32 feet above the ground and 127 feet above the sea) the average rainfall per annum has been as follows:

In 5 years, 1845 to 1849, inclusive,	23·56	inches.
Do. 1850 to 1854 „	19·76	„
Do. 1855 to 1859 „	22·06	„
Do. 1860 to 1864 „	22·25	„
Average of twenty years at Holbeck	21·91	
Average (per annum) of the same period of 20 years:		
At Keswick	58·38	inches.
At Seathwaite	139·03	„
Average of 5 years, from 1860 to 1864 inclusive:		
At Settle (on the Ribble) 498 feet above the sea	40·64	inches.
At Arncliffe (Wharfedale) 750 feet above the sea	58·22	„
Average of five years, 1861 to 1865 inclusive:		
At Settle	39·36	inches.
At Arncliffe	56·69	„
At Otley (Wharfedale) 206 feet above the sea	27·43	„
Average of four years, 1862 to 1865 inclusive:		
At Settle	38·76	inches.
Arncliffe	55·88	„
Otley	27·46	„
Broughton in Airedale	35·70	„

Rainfall in 1865.

At Settle, 498 feet above the sea	35·38	inches.
Thornton in Craven, 456 feet above the sea	30·59	„
Skipton, Airedale, 430 feet above the sea	32·68	„
Broughton, Airedale, about 400 feet above the sea	35·12	„
Leeds, Airedale, 127 feet above the sea	20–65	„
Arncliffe, Wharfedale, 750 feet above the sea	47·26	„
Ilkley, Wharfedale, 500 feet above the sea	36·30	„
Otley, Wharfedale, 206 feet above the sea	24·81	„

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The following Table shows the Percentage in each Month of the total Rainfall during the Year (taken on an Average of 20 years) at the Places named.

	At Holbeck, Leeds.	At Keswick.	At Seathwaite.
	Per cent.	Per cent.	Per cent.
January - - -	8·3	12·4	11·9
February - -	5·1	7·3	8·6
March - - -	7·2	6·6	7·2
April - - -	7·1	5·0	5·5
May - - -	6·5	4·5	4·7
June - - -	10·4	6·8	6·4
July - - -	9·1	7·4	7·3
August - - -	10·5	8·6	8·6
September - -	9·5	8·3	7·3
October - - -	11·0	11·6	11·0
November - -	7·5	10·2	9·9
December - -	7·8	11·3	11·6
	100·0	100·0	100·0
Per-centage in seven summer months, March to September - -	60·3	47·2	47·0
Per-centage in five winter months, October to February - -	39·7	52·8	53·0
	100·0	100·0	100·0
Per-centage in six summer months, April to September - -	53·1	40·6	39·8
Per-centage in six winter months, October to March - -	46·9	59·4	60·2
	100·0	100·0	100·0

At Partington in the East Riding of York, on an average of 10 years, the per-centage is:

Six summer months, April to September -	55·3
Six winter months, October to March -	44·7
	100·0

Number of Days in which Rain was found in the Gauge ta the following Places:

Period.	Name of Place.	Number of Days.	Per-centage of the whole period.	Average rainfall per day.
During 1865 -	Weetwood, near Leeds -	142	39	·172
	Derwent Island, Cumberland.	139	38	·354
In 1866 six months only January to June - -	Weetwood near Leeds -	103	57	·122
	Derwent Island, Cumberland.	82	45	·366
	Borrowdale, Cumberland	106	58	·715
	Isle of Skye - - -	116	64	·388
	Manchester - -	84	46	·149
	London - - -	93	51	·183

(Signed) Thomas Fenwick.

Mr. L. Ellison.

Mr. Lambert Ellison (Knaresboro') examined.

5771. (*Chairman.*) You reside at Knaresboro'?—Yes.

5772. I believe that you are connected with waterworks there?—I am the proprietor and manager of some small waterworks which supply the town there.

5773. Are they private works?—They are.

5774. What number of gallons do you supply per day?—About 70,000.

5775. How long have those works been in existence?—100 years; the Act was got in 1764.

5776. How many people do you supply?—About 4,000.

5777. Do you supply any manufactories?—No.

5778. About what income do those waterworks bring in?—I do not know that I should like to state that.

5779. Or what they cost?—No, they have been in my family for many years.

5780. What do you wish to state about them?—The people in the town of Knaresboro' are perfectly satisfied with the water, but they complain that the sewage of Harrogate which is situated about three miles above runs into the river, and they threaten me with new works if I do not remedy that evil.

5781. Where does your water supply come from?—From the river Nidd which runs from above Pateley Bridge.

5782. Does the river Nidd flow through Harrogate?—No, it is about three-quarters of a mile or a mile above it, but the people of Harrogate run a great part of their sewage into it.

5783. Will not the common law of the land enable you to compel the Harrogate people to keep their sewage out?—I do not know that it would. I might perhaps have to go to Chancery, and I am too old to go to Chancery.

5784. Then you want to see some public law passed which shall prevent this form of pollution?—Yes, so that we could get a remedy in an easy way. About a month ago I went to Croydon with the surveyor from Harrogate, to see what could be done. I believe that the local board of health are willing to do what is right, but they cannot hit upon the best plan of doing it, and perhaps they are a little dilatory.

5785. Is there land upon which they can put their sewage by irrigation, as at Croydon?—They might have some little difficulty in doing it; it is rather a hilly country, but I think that by having a drain pipe they might do it.

5786. That is a question for the local board?—Yes, and also for their surveyor.

5787. What further observations do you wish to make to this Commission?—I do not know that I have anything else to say, except that I think there ought to be some easy remedy; there ought to be a process by which the matter could be gone into before magistrates.

The witness withdrew.

Mr. E. Filliter.

Mr. Edward Filliter (Leeds) examined.

5788. (*Chairman.*) You are a civil engineer?—I am.

5789. In practice in Leeds?—Yes.

5790. You have had considerable experience in waterworks?—I have been engaged in waterworks for a great part of the time that I have been in practice.

5791. I think that originally you were a pupil of Mr. Wicksteed?—Yes.

5792. And you have been brought up under him?—Yes.

5793. You have been acquainted with the different great waterworks of England since your pupilage?—Yes.

5794. You are in practice as a private engineer in Leeds?—I am.

5795. You are employed by the corporation of Leeds in some capacity?—I am employed by them as engineer to their waterworks, and also as inspecting engineer for their sewerage.

5796. The waterworks having been transferred to the corporation are entirely under your charge?—Yes.

5797. And you advise the borough surveyor upon any occasion when your services are required?—Yes.

5798. I suppose that you were engaged by the corporation in the last session of Parliament to enable them to get their Improvement Act?—Yes.

5799. At that time I presume you got up certain statistics of Leeds, both as to its sewerage and as to these becks as a source of water supply?—We got up statistics with reference to the sewerage and the state of the town, and so on, they were chiefly got up by the surveyor, who no doubt will be able to produce them if required.

5800. In what condition did you find the becks flowing through Leeds?—The becks for the improvement of which we obtained an Act of Parliament last session are in a deplorably dirty condition.

5801. Dirty by local pollution?—From pollution, not wholly arising within the borough in one instance, but wholly arising within the borough in the two other instances. There were three becks which we dealt with, namely, the Dow Beck in Hunslet, the Wortley Beck which falls into the river Aire just above Victoria Bridge, and the Sheepscar Beck, or the Addle Beck, as it is sometimes called, which falls into the river Aire at East Street. The Holbeck Beck or the Wortley Beck receives dye refuse and refuse from mills without the borough, and we had no power and have no power so far as I know as a corporation to touch them. In the other cases, that is to say, of the Addle Beck and the Dow Beck, the nuisances arise within our corporate jurisdiction.

5802. Do you know whether the borough surveyor has made any tabulated list of the several manufactories on these streams?—He has.

5803. New plans of sewerage have been carried out to some extent in Leeds; did you advise the corporation as to those plans?—Upon those which are now being carried out I am advising them, but the main sewerage which is in existence for the entire borough was originally constructed by Mr. Leather.

5804. Then you are not responsible for the great outlet sewer which goes down below?—No, it was constructed before I came to Leeds, or had anything to do with it. The chief respect in which I have had to do with the main sewerage, as to the engineering part of it, has been the construction of flood outlets for that sewer; we found that though it was a very large sewer it was not large enough in flood time to take the whole water poured down from the streets, and we consequently had cellars flooded, and I had to construct very considerable outlets on the course of that sewer so as to enable it to discharge into the river during those periods.

5805. Having had considerable experience of engineering works of that class, would you say that in laying out the main sewerage of a town like Leeds, or in fact of any town, it would be advisable te construct sewers sufficiently large to take extensive floods, or that the proper way would be to construct your sewers for sewer work, and to construct flood outlets?—I think that the better plan is to construct sewers of the ordinary size to take the sewage water down them, and where practicable to construct flood outlets.

5806. You would not make a rule of three sum of the matter by taking the rainfall and the area, and from them obtaining the size of your sewers?—Far from it; we should get very large sewers if we did. I look upon streams as the proper carriers of flood waters.

5807. The surface and the streams?—Yes, and the sewers in my opinion should only take the refuse and such ordinary rain as may fairly be taken into them, but not the floods.

5808. (*Mr. Harrison.*) Are the works which you have carried out overflows from the sewer itself?—They are.

5809. They are not what you would call flood outlets direct into the river?—No, they are overflows from the sewer into the upper mill pool, into the tail of which we pour our sewage; in fact the pressure is sufficiently great in the sewers during floods to drive the water into the upper mill pool.

5810. So that in flood time the sewage discharge instead of being below the town of Leeds is nearly opposite to it?—Yes, but that is only in very considerable floods.

5811. (*Chairman.*) And when the water is diluted down to the flood quality?—Yes.

5812. It then ceases to be sewage?—Yes. I do not think that these outlets act more than once a year, but when they do act they are an immense advantage.

5813. Have you kept a record of the rainfall for any number of years?—I have a record of the rainfall of Leeds extending back for something like 20 years.

5814. A record week by week, month by month, and year by year?—Quite so.

5815. Have you it by you?—I have in my pocket-book the statement month by month, but not week by week.

5816. Taking the summaries of years can you tell me the least fall and the greatest fall?—Yes, from the year 1849, at Leeds, up to 1865 I have it.

5817. What has been the least fall in any one year from December to December?—In the year 1864 I have the lowest record, namely, 17.04 inches.

5818. What is the highest?—The highest was in the year 1852, when we had 32·18 inches.

5819. It was nearly as two to one?—Yes, that is about the usual rule, so far so I have observed it in these districts.

5820. As a waterworks engineer would you say that the average rainfall for 20 years would be of any practical service to you without the minimum and the maximum?—No doubt you cannot make a thoroughly complete scheme, unless you have the minimum and the maximum.

5821. If you had to depend upon storeage would not the minimum rule the quantity of storeage?—Certainly.

5822. And the maximum would decide the character of the mischief to which you might be subject?—Quite so.

5823. The average is a piece of information useful in its way, but cannot be the foundation upon which you would work?—Yes; as a waterworks engineer of course I am aware that the maximum is essential with reference to the question of overflow and reservoir embankments and so on, but in respect of supply, the minimum undoubtedly is the real thing to look at.

5824. Have you any record of the maximum fall in any one hour in this area during those 20 years?—I have records here to within a few weeks; we take the facts day by day, and I can obtain the results of a number of excessive rainfalls within any one day, but I cannot state whether those have fallen within an hour, or more or less.

5825. You say that you know what the rainfall of the county and the country generally is?—Yes.

5826. In the whole of England it varies, I think, from about 17 inches up to 70 inches?—Yes, we have it 140 inches in Seatollar and Seathwaite, in Borrowdale, in the Lakes.

5827. What is it on the eastern coast?—About 18 inches according to my memory.

5828. Do you know whether you are liable to as heavy thunder storms where you have the least fall of rain as where you have the greatest?—I do not.

5829. You have thunder storms in this part of the world?—Of course. I remember perfectly that at Scarborough in the year, I think, 1856, a tremendous thunder storm occurred which filled their rain gauge, and they obtained more than nine inches of rain within an hour or two, for their rain gauge only held nine inches and it ran over.

5830. Then an engineer having to devise river works or drainage works, would be very much deceived as to the damaging effect of flood waters, if he took the usual rainfall?—No doubt.

5831. An excessive flood might be as damaging in a district where the annual rainfall was 18 inches as in a district where it was 70 inches?—Yes, and the Derwent and the Rye, the two rivers which drain the East Riding, are peculiarly liable to floods.

5832. In dealing with this question meteorologically, an engineer must know the excesses and the time of those excesses, that is to say, the maximum of damage in the minimum of time?—Quite so,

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5833. Being engineer of the waterworks of Leeds, I presume that you are acquainted with all the details and particulars of those waterworks?—I believe so.

5834. When were they established?—The Act of Parliament was obtained for the present works in 1836 or 1837; the works were completed and brought into operation in the autumn of 1841.

5835. Were those the works which we have heard of, which pumped from the Aire at Leeds Bridge?—No, the works which superseded them.

5836. When were the first works established for pumping from the Aire at Leeds Bridge?—That I can hardly state; I believe they were erected 40 or 50 years before, but upon that point I can give no evidence; they continued until the year 1841, when they were superseded by the works designed by Mr. Leather.

5837. Do you know about what volume was pumped at Leeds Bridge just before the works there were abolished?—I think that I have a record which will enable me to give you that detail.

5838. Where were the works removed?—To a small gathering ground, at that time about 1,000 acres, at Eccup in the watershed of the Wharfe.

5839. (*Mr. Harrison.*) Is that near Addle?—Yes; that gathering ground was for a time found to be sufficient. Eventually more water was required; the reservoir at Eccup was enlarged by heightening the bank, a conduit was formed from it to Stubhouse to take the Stubhouse Beck, which gave another 300 or 400 acres of drainage ground, and so increased the quantity. That, however, was not sufficient; the town increased and a dry year came.

5840. (*Chairman.*) Do you remember at what date the dry year was?—I think that it was the year 1851, but I was not at that time in Leeds. I find that our consumption in that year was very much below the year before or the year after; the consumption in that year was 951,000 gallons per day, and in the year before it was 1,490,000, and in the year after it was 1,252,000; the houses were 21,000 in the previous year, 22,000 in the year in which the deficiency occurred, and 25,000 in the following year. In the year 1851 they were obliged to put down temporary works below Harewood Bridge; those works were constructed with the consent of Lord Harewood, and the pipes were laid through his park. Eventually the Corporation who succeeded the old water company were unable to make permanent arrangements with Lord Harewood, and those works had to be removed and new works constructed, for taking 2,500,000 gallons a day at Arthington, where they are now situated. In the year 1862 we got an Act of Parliament for enabling us to pump 3,500,000 gallons per day, in addition to what we previously had power to do—that makes 6,000,000 gallons a day from the Wharfe, and 750,000 gallons from Eccuy in dry weather, so that about 7,000,000 gallons is our total quantity.

5841. Have you ever taken that quantity from the Wharfe?—No; we have never pumped 6,000,000; we have put up an additional steam engine to enable us to do so, but we have not, as we intend to do, added to our line of pumping pipes, and we have had some difficulty in keeping both our sets of engines at full speed; we have never yet pumped the 6,000,000 gallons, but we have never required it.

5842. What number of gallons per head would 7,000,000 gallons give you?—At the last census the population was 207,000, but we believe it now to be 240,000—that would give 29 gallons per head per day.

5843. What volume do you supply for manufacturing purposes?—At the present time we supply about 500,000 gallons per day for manufacturing purposes—about one-ninth of our whole supply. Our total supply now is about 4,500,000 per diem.

5844. Where do the manufacturers usually get their water?—The great bulk of supply is from the river Aire, for the manufacturers are scattered up and down the banks of the Aire; they supply themselves also largely from bore holes in the sub-soil in the coal measures below.

5845. What quality of water is so procured?—I believe that it is a very high alkaline water. I once had an analysis made of some from a bore-hole at Beeston, and I think the water contained between 50 and 60 grains to the gallon; a large portion of that was alkaline salt.

5846. Then it would be apparently softer than pure water?—Yes, and it is very much valued on that ground. The Spa water as it is locally called is a good deal used in Leeds for making tea, and persons find it a profitable trade to take the water in carts and to supply it to the inhabitants, though I believe that that trade is very much diminished.

5847. It is found to be so much cheaper in making tea?—It is found to act so much better in making an infusion of tea.

5848. (*Professor Way.*) It makes very dark tea, I suppose?—Yes; I expect that it is the colour more than the flavour.

5849. It is not what you and I would like to use?—I do not use it at my own house, I use the town's water.

5850. (*Chairman.*) What extent of engine power do you use at your waterworks?—Two double acting 100 horse power engines, and one single acting 300 horse power engine, making 500 horse power.

5851. Are those engines rotary or direct acting?—The older pair are rotary, working a bucket and ram pump; they are all beam engines. The larger engine has a plunger pump on the system of the Cornish engine.

5852. What coal do you use?—We get ordinary Yorkshire coal; we used to have it from the north, and we do so now occasionally, but from the difficulties of getting coals from the north we now generally use West Riding coal.

5853. Laid down at what price?—Our prices have varied; we are now paying 7*s.* 9*d.*, that was the last price which was quoted if I remember rightly, that is for ordinary slack.

5854. Do you remember what weight of coal is required for each nominal horse power?—I have not worked that out. I think that our Cornish engine is doing between 50,000,000 and 60,000,000 duty, and the others are doing about 25,000,000 or 30,000,000.

5855. What do the Cornish engines do?—The best Cornish engines with Welsh coal do 90,000,000, and in short trials of 24 hours 120,000,000. The coal which we get is very inferior to Welsh coal.

5856. What would that be per million gallons lifted 100 feet high?—I can easily give you that. I know that our working expenses, exclusive of interest upon capital, are a halfpenny per 1,000 gallons lifted 250 feet high, and about another halfpenny for interest upon capital, including rent of land.

5857. Do you think that sewage might be lifted at as cheap a rate, upon the same scale as that upon which you are lifting water?—I have no doubt of it; in fact it is practically done, as you know very well, both at Leicester and in London, and elsewhere.

5858. At a halfpenny per 1,000 gallons, 250 feet high?—Yes, about that, within a fraction.

5859. I assume that small engines would not work so economically as your large engines; that is to say, with engines of 30 or 40 horse power people must expect to pay a much larger price?—Not a very much larger one, but there is a proportionate difference. The old Cornish rule is not a bad one; namely, 1,000,000 an inch. As far as my own experience goes, I should say that that is very nearly the truth.

5860. That is to say, an increase of 1,000,000 an inch in diameter?—Yes.

5861. What is the relative cost of a rotary engine, and a Cornish engine, per horse power?—Of course a Cornish engine is a single engine, and a rotary engine is a double engine, therefore in one case you have a smaller engine to do the same work, and so there ought to be a difference in favour of a rotary engine in the first cost. However, I have not found it a very great difference in actually constructing works. At the last Leeds works the cost of the Cornish engine, which will pump 3,500,000 gallons per day, was very nearly the same as that of the two 100 horse power engines pumping 2,500,000 gallons per day. No doubt some-

thing, and probably a good deal, must be allowed for the fact that the first set of engines was a pair where all the workmanship was doubled, whereas the other is a single machine, though no doubt massive.

5862. What was the cost of your Cornish engine?—About 10,000*l.*

5863. How much is that per horse power?—About 33*l.*; that of course included boilers.

5864. I have heard that Cornish engines cost as much as 70*l.* or 75*l.* per horse power?—Yes; I know engines which have cost a great deal of money. At Lee Bridge, the engine for the East London Waterworks cost 25,000*l.* altogether.

5865. Is that cylinder 100 inches?—Yes.

5866. Is that the largest cylinder?—The cylinder, 144 inches diameter, of the engine used for draining Haarlam Lake is the largest. I do not know a larger cylinder used for pumping purposes for waterworks than a cylinder of 110 inches. We call our engine 300 horse power, and it cost 10,000*l.*; that gives 33$\frac{1}{3}$*l.* per horse power. I may say that that was not the lowest tendered price.

5867. With regard to the outlet sewer, constructed by Mr. Leather, you know, I suppose, very well the point of discharge into the river, and the intervening land through which it goes?—I know the point of discharge very well, and I have seen the intervening land occasionally.

5868. Are you aware whether any private arrangement was made with the owner of that intervening land for the right to take that sewer there?—Yes; Mr. Meynell Ingram, who owns the property there, was compensated by an annual payment of 300*l.* for the injury which might be done to him.

5869. Is that payment to be continuous?—Yes; it was a payment to him for the right of way and discharge of sewage through his estate. We went for a considerable distance at Knostrop through his property.

5870. Has there been any talk of establishing sediment tanks, or means for purifying the sewage before passing it into the river?—Yes. When the Leeds sewerage works were first constructed, the question of purification by lime, similar to the Leicester plan, was a good deal discussed in Leeds, and the corporation took the precaution at the time of making an arrangement with Mr. Meynell Ingram, by which they could at any time purchase 20 acres near their outlet at a fixed price. That deed is in force, and the corporation may act upon it to-morrow if they please.

5871. Had you anything to do with devising the Leicester works?—I assisted in making the plans, but I had nothing to do with the management of the works. I have never had an opportunity of seeing the works in operation. I saw the experimental works in operation which were made there first of all, but I have never seen the complete works.

5872. What is your opinion of that experiment, practically, as an experiment?—Commercially, it is a complete failure; but as regards the purification of the river, all that I have heard of it, and all that I had seen of it previously, leads me to believe that it is successful enough. The residuum was not worth fetching away.

5873. The residuum did not bring what was anticipated?—No, far from it.

5874. Do you know whether, during the laboratory experiments, it was considered that it would be valuable as a manure?—Yes. Professor Alfred Taylor and Mr. Aikin both reported that it was a very valuable material.

5875. And did they consider that the works would commercially pay?—Their report was simply a chemical one, as to the constituents of the material obtained.

5876. (*Professor Way.*) In what year was that?—I think in 1847, but I could not be positive.

5877. That, I suppose, was at a time when much less was known about the value of manures than is now known?—Yes.

5878. Mr. Aikin has been dead for some years?—Yes.

5879. He was a chemist of the old school?—He was.

5880. (*Chairman.*) In the event of the Leeds corporation having compulsory powers put in force against them as to their sewage, do you anticipate that they could disinfect it with any profit to themselves?—No; we do not at present anticipate that there is any hope of that.

5881. You think that if they are compelled to precipitate and purify, as at Leicester, they must do it at a loss?—I feel no doubt of it, with our present knowledge upon the subject.

5882. Have you inspected any places for using sewage for irrigation purposes?—I have inspected Croydon, which I believe is about the best instance.

5883. Have you formed any opinion as to the effect of sewage upon the land there?—Yes. I do not think that an opinion merely formed by passing over the fields once is worth a great deal, but I am perfectly satisfied that the effect of purification was actually produced by the running of the water over the surface of the grass.

5884. The effluent water had lost a great deal of its character of sewage?—I may say entirely so; it was bright, and very sweet.

5885. How long is it since you were there?—It was last March or last February.

5886. You have not been there during the heat of summer?—No. At the time when I was there they had stopped a portion of the works for the purpose of making some repair to a drain, and they had to turn some of the sewage into an adjoining pond, where it stagnated. The smell anywhere near the pond was very offensive; we could smell it for many yards, perhaps 100 or 200 yards off.

5887. Is Leeds sewage offensive in smell in summer?—It is.

5888. Are you aware whether there have been any complaints by the landowners in the district?—I have heard of no complaints being made by them, I may say that there is no residential property so immediately adjoining the river as to make it likely that there would be any ground for complaint.

5889. Have the Aire and Calder Navigation Company complained of banks being formed in the river by solids sent out at the outlet?—I am not aware that they have made any official complaint, nor do I remember any actual complaint of the kind; at the same time I think it very probable that something of the sort may occur.

5890. The company do dredge in the river?—Yes.

5891. There is some agitation in Leeds with regard to a new water supply for Leeds?—That is so.

5892. I also see by the report which you kindly sent me some time ago that you have a scheme for an extension of the supply?—That is the case.

5893. Upon what ground is that extension sought to be made?—On account of gradual increase which is taking place in the consumption of water in Leeds, not only do we wish for an extension, but we are going for a purer supply; the cause of our doing so is the gradually increasing impurity in the river Wharfe, from which we now obtain our supply; I mean increasing impurity above the point where we pump.

5894. What is the quality of the water which you take?—The degree of hardness is about 8$\frac{3}{4}$, as ascertained last spring; it varies generally from 8 to 10 degrees; when supplied to Leeds it contains about 1$\frac{1}{4}$ grain of organic matter per gallon.

5895. Then it comes into the category of what we should call hard water?—Yes, it is rather a hard water.

5896. It is not so hard as the metropolitan water?—No, and it softens a good deal, as all waters of that class do, by boiling.

5897. (*Professor Way.*) But not nearly so much as chalk water would?—Certainly not.

5898. (*Chairman.*) What are the points of contamination above your pumping works?—The Pool paper and worsted mills, the Otley mills, the worsted mills at Burley, the mills at Addingham, the sewage of Otley, where there is an incomplete system of sewerage, and the surface drainage of Burley, which has no sewerage.

5899. Have you any tanneries?—Yes, there is one at Otley, and there is some sheep-washing at Otley Bridge.

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5900. If that pollution were prevented as it will be in the Thames, would it at all affect the question of your removing the supply from the present pumping stations?—I believe that it would; I believe that the inhabitants of the town would have been satisfied with the water, notwithstanding its comparative hardness, if there had been no offensive matter discharged into the river.

5901. And no possibility of the growth of that offensiveness by the growth of population?—No doubt.

5902. Are you aware of any complaint having been made in Leeds by the medical men, or others, as to the quality of the water affecting the health of the population?—I have never heard a complaint of that kind.

5903. Does the question of extension simply involve the question of purification?—We also require a larger quantity.

5904. And also, I assume, you wish to get water by gravitation instead of by pumping?—That is a part of the scheme. We also require, and would gladly have a soft water; a soft water lies very close to us, and we are seeking to obtain it.

5905. Did you ever investigate the comparative cost of gravitating and pumping schemes?—Yes, it entirely depends upon the distance from which you have to gravitate, and the height to which you have to pump, and therfore I do not think that any very general rule can be given in the matter; In our own case, when I estimated for 20,000,000 gallons a day, I found that it was cheaper to gravitate than to pump, at the distance from which we should gravitate, but I question whether that rule would have been held if instead of going for 20,000,000, we had gone for half or a third of 20,000,000.

5906. It does not therefore follow that a gravitating scheme is cheaper than a pumping scheme, because you have no annual cost in working?—No, because on the other hand you have the annual interest to pay upon your outlay.

5907. In your pumping scheme you have no impounding reservoirs to provide?—No.

5908. Do you give any compensation in the shape of money?—Yes, we have given compensation to the millowners below us in money.

5909. What would be a set-off against providing compensation reservoirs in the other case?—No doubt of it.

5910. Then you have the annual cost of working which represents the interest of the capital necessary for going further a field in the gravitating scheme?—Quite so.

5911. Therefore, it becomes a consideration which scheme is the most effectual of the two?—Yes; and it probably will vary in every case.

5912. Have you formed any estimate of the comparative value of waters in proportion to their hardness or softness?—No. I have seen statements upon that question, but I have never at all gone into it myself.

5913. Have you seen statements of Mr. Bateman with regard to the scheme in Glasgow, which has been talked of lately?—Yes; I am quite satisfied from all the evidence which I have seen that a soft water is better for a large manufacturing town than a hard water.

5914. That it is more economical?—Yes.

5915. Both for boiler purposes, and for culinary purposes, and even for drinking?—Quite so; and by filtration we make it so bright and so pleasant to look at, that we overcome the objection which may be made to a soft water brought, as it sometimes is, directly into a town without filtration.

5916. (*Professor Way.*) Has the water in the bottle before us the colour of peat?—There is peat in our water. We have had peat in our water during the last six weeks.

5917. (*Chairman.*) Do you use any system of filtration?—We filter on the ordinary system of sand filtration at a place called Weetwood, about three miles from Leeds; the water is passed to our large reservoir and filter beds at Weetwood, where it is filtered.

5918. What depth of sand do you use for filtering?—18 inches.

5919. What is the area?—We have now about 11,000 square yards.

5920. How many gallons would a square yard filter in the 24 hours?—We supply 4,500,000 gallons a day through that 11,000 square yards and could do more. I have passed the whole of that quantity through one-third of that area in the time, and therefore if we could clean the beds fast enough 3,500 square yards might be made to do for 4,500,000 gallons per day. Of course I do not recommend that.

5921. Have you any strict rule which you follow with regard to area?—Yes, I have always adopted the old Lancashire rule, and I find it even excessive as regards filtration surface; that rule is 2 square yards for each gallon per minute; that works out to about 720 gallons a day per square yard.

5922. Then the rule of a gallon per square inch in 24 hours would be very much in excess of that?—Yes, it would be nearly double that.

5923. Do you use in your filter bed anything besides sand?—Not at Leeds. At Wakefield where they have the carbide I am putting down two filter beds.

5924. You have not thought it necessary to use any of the carbide in Leeds?—No, the expense was the great reason; I made the filter beds about five years ago, and if it had not been for the cost of the carbide I should have introduced it.

5925. Taking your Wakefield experience, what is your opinion of the carbide?—I think that it is a very good thing. I am satisfied that it has a remarkable effect in purifying water.

5926. And in taking out such stain as you find in the water of these rivers?—Yes; I have seen the water at Wakefield quite peaty at times, and the peat stain is entirely removed by the filter beds.

5927. What would it cost to add the necessary amount of carbide to the Leeds filters?—About 20,000*l.*, and it would have trebled the expense of the filter beds.

5928. About what would be the thickness of the carbide?—It would be 6 inches thick, and mixed up with sand.

5929. Does not Mr. Spencer recommend that it should be used below the sand and entirely by itself?—I think that it should be mixed with the sand so as to get as much surface as possible, and placed below the sand; the carbide would thus act chemically upon the matter contained in the water.

5930. (*Professor Way.*) We understood Mr. Spencer to say that he did not wish it mixed?—I did not hear his evidence, so that I am not acquainted with what he now recommends. I know that he has recommended mixing.

5931. (*Chairman.*) From what source do you propose getting your supply at Leeds?—From the river Washbourne.

5932. Of what quality is that water?—It varies from $2\frac{1}{2}$ to $4\frac{1}{2}$ degrees of hardness.

5933. Coming from what stratification?—From the millstone grit.

5934. Is it very brown in colour?—Sometimes. Frequently when I have been down at the junction of the Wharfe and the Washbourne the Washbourne has been very much more transparent, and actually freer from peat stain than the Wharfe. That water is $2\frac{1}{2}$ degrees of hardness at the point where we gravitate, and it is $4\frac{1}{2}$ degrees at the mouth of the Washbourne.

5935. I suppose that it gets its lime from a surface source?—Yes, I think chiefly so. The land on one of the chief branches of the Washbourne has been a good deal cultivated with lime for the last year or two, and perhaps more, and I know that that is a hard feeder; it is of about $6\frac{1}{2}$ degrees of hardness. Greenhow Hill, at the head of the Washbourne, supplies limestone; the limekilns through the whole district are fed with lime from that hill, but within the valley of the Washbourne itself there is very little lime. I only know of one place.

The witness withdrew.

Adjourned to to-morrow at 11 o'clock.

Leeds, Wednesday, 7th November 1866.

PRESENT:

ROBERT RAWLINSON, ESQ., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, ESQ. | Professor JOHN THOMAS WAY.

EDWARD FILLITER, ESQ. (Leeds), further examined.

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5936. (*Chairman.*) I believe you have prepared a plan showing the land that might be made available for application of sewage by gravity?—Yes.

5937. Is that the Ordnance map?—Yes, on an inch scale, showing Leeds and the valley of the river Aire below Leeds for about 15 miles down to this point (*pointing to the plan*).

5938. You have shown on that plan what number of square acres are available?—Yes, for application by gravitation. In the district below Milford Junction about 10,000 acres might be made available.

5939. Are those 10,000 acres lying within the reach of gravitation?—Yes; but nearer to Leeds, and therefore not necessitating so long a conduit, if pumping 25 feet high was resorted to at the existing outlet of the main sewer, there is an area that might be obtained free from residential property in the valley of the river Aire of about 5,000 acres.

5940. What would the expense be per million gallons of pumping?—I have made a calculation not founded upon our experience in pumping to high lifts, but for small engines applicable to low lifts, and I believe the cost of pumping a million gallons 10 feet high would be 5*s.*; 20 feet high, of course, 10*s.*, and so on up to 12*s.* 6*d.* for 25 feet high.

5941. That cost would represent the working expenses?—Yes, but it includes the interest upon capital as well; in fact, in round numbers the total cost.

5942. Do you know how many million gallons a day ordinarily pass out of the sewage outlet?—I had the dimensions taken of the outlet culvert some years ago, and I ascertained that the delivery varied from 6,000,000 to 8,000,000 gallons a day at that time. I mean some three or four years ago. The sewage has increased since then, but I have not measured it since.

5943. Are the sewers so arranged at the present time that they take in any large volume of beck water and subsoil water?—They will take in a certain volume of subsoil water, but I do not think they take in any beck water, and for this reason; we were bound by the Act of Parliament under which Leeds was sewered in 1848 to exclude all living streams, and that has been I believe carefully attended to.

5944. What is the volume of water that is pumped into Leeds?—About 4,500,000 gallons.

5945. What volume of water is obtained from other sources?—I do not know.

5946. Then there are wells on premises of manufacturers?—Yes, but they are decreasing in number and in yield.

5947. Do you think there is 1,000,000 gallons a day obtained from all the other sources?—It would be a very rough statement to make, and I should not much like to say.

5948. Suppose I take 500,000 gallons as representing the loss in evaporation and waste. Do you think 4,000,000 would find their way into the sewers?—Yes, I think that is probable.

5949. At the outlet you found that there were from 6,000,000 to 8,000,000 gallons?—Yes.

5950. Therefore your subsoil water is nearly double the water supply?—Yes.

5951. That being so, any pumping that might be resorted to would involve the lift of that quantity?—Yes.

5952. I mean that you must have power to pump 8,000,000 or 10,000,000 gallons?—Quite that, and probably more by this time.

5953. If I assume that there will be 10,000,000 gallons to be lifted 25 feet at 12*s.* 6*d.*; that would be 6*l.* 5*s.* 0*d.* a day?—Yes.

5954. And that spread over 365 days would be how much?—The cost of the pumping would be nearly 2,300*l.* a year.

5955. If the land could be dealt with as at Edinburgh and at Croydon and other places, and it could be increased in value from 50*s.* per acre up to 20*l.* per acre, there would be a margin left for the payment of that cost of pumping?—Yes, there would be a very handsome margin of profit in that case.

5956. Taking the population at 240,000, what area would there be, 150 persons to the acre?—There would be an area of 1,600 acres, but our drainage area is not anything like so small as that.

5957. You mean for application of sewage?—Yes.

5958. You think you could utilize it very readily upon that area?—Yes, so far as the works are concerned.

5959. If you increase the land by 2*l.* an acre in value per annum, what would that give?—3,200*l.* a year and that would more than pay for the pumping.

5960. If land was found available, does not experience show that a profitable arrangement of that kind might be made?—That is undoubtedly the case.

5961. The area of land required is not so overwhelmingly great?—Not if 1,600 acres are considered sufficient.

5962. (*Mr. Harrison.*) Could you not obtain on the banks of the Aire as many as 1,600 acres to which the sewage might be led by gravitation?—I have not examined that question, and therefore I cannot answer.

5963. (*Chairman.*) I believe you have laid before the corporation of Leeds recently a scheme for a water supply both for the present and for a considerable future period?—Yes, that is so.

5964. Have you the plans and the details before you?—I have not the details here, but I have some few calculations having reference to that point.

5965. What do you call the areas from which you intend to draw water?—There is the river Washbourn, the area of which is 25½ square miles.

5966. What do you estimate to be the volume of water?—There is estimated to be 23,000,000 gallons per day from that area.

5967. What is the rainfall over it?—I have no actual records of that, but I calculate it to be 36¾ inches per acre. It is a very lofty district.

5968. What proportion of that rainfall would give you the volume you propose to deal with?—16⅓ inches.

5969. And what would you give in compensation to the stream?—At the rate of 8⅓ inches of rain.

5970. What is the minimum flow of the river?—It is about 3,000,000 gallons a day in very dry weather indeed.

5971. Do you know the area above?—It is about 25½ square miles in acres rather more than 16,000 acres.

5972. What would the flow be off that ground per second from each 1,000 acres?—Much less than half a cubic foot per second.

5973. You know that?—Yes, I know that it must be so.

5974. What other area do you propose to deal with?—I have gone forward to the river Nidd and the river Burn, but they are so very far remote that there is no prospect, I suppose, of that being done in our time.

5975. Then the Washbourn is the area to which

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you are looking for the present supply?—Yes, for the next 20 or 30 years to come.

5976. The others are not merely alternative schemes?—No, they are merely extensions of the first, if they should be ever required.

5977. Are those areas likely to be forestalled for any other purposes, commercial or mining?—I think not for commercial purposes. I think the rivers are not likely to be forestalled, because an attempt has been made during the last 50 years more than once to establish flax, silks, and cotton mills upon the Washbourn, but they have all failed.

5978. What is the geological character of the area to which you intend to resort?—It is the millstone grit formation with a little limestone at the upper end of it.

5979. Are there any minerals beneath it?—People have attempted to obtain iron-stone and coal in the valley of the Washbourn, but every attempt that has been made has proved a total failure; there is not a sufficiently thick bed of either to make it worth while to undertake mining operations.

5980. Are the beds very thin?—Yes; and the same thing occurs in the valley of the river Burn, and the Nidd people work an inferior coal in those districts.

5981. What is the fall of the river Washbourn per mile; are there good reservoir sites in it?—Admirable.

5982. What will be the capacity of the largest reservoir you intend to make?—The largest reservoir that I intend to make is a compensation reservoir, which is to hold 890,000,000 gallons, covering an area of 113 acres, the extreme depth being 56 feet.

5983. What would be the next in size?—One that would hold 600,000,000 gallons, with an area of 118 acres, the height of the embankment being 35 feet.

5984. Will there be facilities for increasing either of those banks if you desire it?—Not the upper one perhaps, but the lower one might be increased. There are many other reservoir sites in the valley, and if any difficulty was found in increasing the height of the banks of either of these two reservoirs, other sites might readily be substituted.

5985. Have you had much experience in constructing reservoirs on the millstone grit?—I have not.

5986. Are you acquainted with the Manchester and Bradford Waterworks?—I am.

5987. Do you know that there has been a difficulty experienced in making the embankments tight on those formations?—I do.

5988. Have you had any trial borings taken on the Washbourn?—Not yet.

5989. Will the scheme be a gravitating one or a pumping one?—Partially gravitating and partially pumping.

5990. Have you had the water analysed?—Yes.

5991. What is its quality?—We have had four analyses taken in the valley of the Washbourn, one at Blubber-houses Bridge, the point at which we propose to divert the water to Leeds. These are general and not minute analyses and the hardness appears to be $2\frac{1}{2}°$ at that point, reduced by boiling to 2·2°; the total dissolved matter per gallon is 4·2 grains, of which 3 grains are mineral matter and 1·2 grains are volatile and organic matter.

5992. Is the water discoloured at any time of the year?—Yes, it is discoloured by peat during autumn and winter.

5993. Can you generally separate the peaty water by intercepting drains from the other water?—Part of the plan that I have laid down is to have by-wash channels, and part of the peaty water would therefore be sent down into the compensation reservoir to be stored, the reservoir for the supply of Leeds by gravitation being filled with pure and bright waters, which are in considerable volume after the peaty waters have once flowed out.

5994. What is the length of your conduit down to Leeds?—We do not require a conduit to go further than Eccup reservoir, which is our storage reservoir. To that point the length of the conduit would be about 13 miles.

5995. The details are not yet set out?—No, not yet; they will be for the next session.

5996. (*Mr. Harrison.*) I observe on this map that you have marked two or three of the Bradford reservoirs and gathering ground?—Yes; I have marked the whole of the Bradford scheme upon that plan to show the comparative extent of what I have proposed for Leeds with what has been done for Bradford, and also the relative situation of the works.

5997. I observe in your report that you speak of the Bradford corporation as having occupied certain ground upon which they would not like to be interfered with?—Yes, I do.

5998. I suppose your object in coming forward with this scheme for Leeds is that Leeds may occupy some other ground, whether the scheme is carried out now or not?—I do not think there is any intention of occupying ground not covered by the scheme as regards Leeds; I have no such intention myself.

5999. I observe, in looking over White's Directory, that there is some information given as to the old waterworks; that, "about 1694 they were improved, "and at different times in 1754, 1790, and in sub-"sequent years," that "they pumped the water from "the river Aire at the bridge into a reservoir," that "they raised about 80 or 90 gallons a minute." Are those facts correct?—I have no doubt that they are generally correct, but I cannot say that I know anything of the kind of my own knowledge.

6000. What quantity do you propose to give a day, should you give 90 gallons a minute?—130,000 gallons in a day.

6001. What was the population of Leeds about the year 1836 or 1837?—I cannot say.

6002. It appears from the same directory that the inhabitants numbered 140,000, and that 60,000 of these had no supply from the waterworks. That number deducted from the 130,000 would leave 70,000, and the supply being 140,000 gallons a day would give about two gallons per day for the population at that time?—Yes.

6003. Have you taken into account the increase of population from the beginning of this century down to the present time?—No, I have not.

6004. I find that in 1801 the census gave 53,000?—Yes.

6005. The number increased in 1811 to 62,665; in 1821, to 83,943; in 1831, to 123,549; in 1841, to 150,234; in 1851, to 172,270; and in 1861, to 207,165, the population being at the present time about 240,000?—Yes.

6006. For that population of 240,000 people what is your present supply of water?—4,500,000 gallons.

6007. And 500,000 gallons of that will be taken by the manufacturers?—Yes.

6008. Leaving 4,000,000 gallons for the population?—Yes.

6009. What will that be per head?—A little over 16 gallons a head per day.

6010. Do you anticipate that the population will increase more rapidly in future years than it did increase between 1800 and the present time?—I cannot say that I can form any very definite anticipation upon that subject. There may be more or less of increase, but upon the whole probably the tendency will be not to increase so rapidly as heretofore.

6011. If increase of population goes on at the same rate during the next 50 years, what will the population at the end of that time be, taking the population of 1801 to have been 53,000, and in 1861, 207,000?—If I take it in a similar proportion it would be of course about four times the present population, or about 800,000.

6012. If you look to the increase which has taken place you will see that it has been tolerably gradual throughout the 60 years, it has been increasing at the rate of 5·4 per 1,000 annually, or 3,000 per annum?—That would make it 150,000 in addition to the present 240,000, or in round numbers 400,000.

6013. Supposing you provide 20 gallons per head for that population of 400,000 persons, what will that require?—8,000,000 gallons per day.

6014. What under your present Act is the limit of the volume of water you can draw from the wells?—6,000,000 gallons.

6015. And how much from other sources?—We consider that we get about 1,000,000 from other sources.

6016. That is 7,000,000 gallons which you have at present the power of obtaining?—Yes, or thereabouts.

6017. As far as population goes, even allowing 20 gallons per head per day, you have at present sufficient means of supplying for nearly the next 50 years the population of the borough proper?—Taking that view of the case, undoubtedly it is so.

6018. What sum did the corporation pay for the waterworks to the old waterworks company?—225,000*l.*

6019. To what expense have they gone since that time?—I think the capital account now stands at about 360,000*l.*, as far as I can remember.

6020. What do you estimate you will want between this and the end of the century for manufacturers; do you anticipate that any large extra quantity will be required for them?—I have no doubt that if we bring soft water into the town, there will be a very great increase in the consumption of it for manufacturing purposes, but what that will be I cannot say.

6021. What do manufacturers now pay for water?—Sixpence for 1,000 gallons.

6022. Do you think that they would take a largely increased quantity of soft water at the same rate?—I think they would.

6023. Do you anticipate any very large increase in the quantity that will be required for manufacturing purposes, because in your estimate you are looking forward to 20,000,000 gallons being required before the end of the century; but according to the increase of population, a supply of 20 gallons a head would only come to about 8,000,000 gallons daily?—I have formed my estimate, not upon increase of population, but upon increase of consumption in water. I consider that consumption increases in a greater ratio than population.

6024. Have you made any calculation as to the consumption of 20 gallons per day per head?—I may mention that there has been a very great increase in the number of baths and waterclosets in Leeds, and particularly in waterclosets, they are both of them enormous consumers and wasters of water, and I have very little doubt that if the present system of increase in them continues they alone will largely swell our consumption.

6025. If consumption was increased from 20 to 50 gallons a day you would make out your requirement for 20,000,000 of gallons a day?—Yes, taking population again in the same ratio.

6026. (*Professor Way.*) In the absence of waterclosets, which you say are now increasing, how could 20,000,000 of gallons per day be used?—There are now 3,000 waterclosets in the town; we are, therefore, not without them by any means, but they are not yet applied in anything like the proportion in which they may be used at a future day. I understood the officer of health to say, that his opinion was that it would be well if the watercloset system were applied to the poorer houses; but I am sure that if it is applied to them, unless regulations for prevention of waste are most stringent, and indeed if they are, an enormous increase will take place in consumption of water. In our better houses the use of baths which is now very much on the increase adds enormously to the consumption of water. I may give my own house as an example. I have a meter put on at my house and I pay about 4*l.* a year for water rate. I am using about 300 gallons of water a day for a family consisting of 10 in number, and that is 30 gallons per head.

6027. (*Chairman.*) Are you satisfied that the water is not used extravagantly?—I know that we do not waste it.

6028. You are satisfied that 30 gallons per head are legitimately used?—Yes, but then how does it happen? It is mainly by the baths. I have two baths in my house and those are filled, one of them once a day, and the other twice every day. Each bath holds about 70 or 80 gallons, and in that way the water goes; they are both of them lying down baths.

6029. (*Mr. Harrison.*) Do you anticipate any increased consumption at all similar to that by the poorer classes?—No, I do not think that is likely to happen. If there was a very great increase, however, in the system in the better class of houses that would soon run up our consumption. One is obliged in estimating to set quantity sufficiently high, and indeed my estimate has been found fault with as being too low. I do not think myself that it is too low, but that it is sufficient, abundantly sufficient.

6030. What is the metropolitan supply per head?—About 33 gallons a day.

6031. (*Professor Way.*) You are aware no doubt that in London water is very largely wasted?—Outrageously so; I know that well. We are on the constant system here, and we are obliged to watch the supply narrowly in order to prevent waste, but in spite of that it has occurred.

6032. (*Mr. Harrison.*) Are most of the houses supplied with water?—Yes; the total number of houses by the census of 1861 was only 46,000.

6033. Your experience now with a constant supply is that people only take about 16 gallons a day?—Yes, that is so.

6034. With a power of taking what they like?—Yes, with a power of taking twice that quantity if they please.

6035. Why should you think that they will want as much as 50 gallons in the course of 50 years if they take 16 now and may take 50 if they choose?—But that is again referring to the question of 20,000,000 of gallons a day; I am anxious to make a sufficient provision. I cannot say how they may be used.

6036. What is your estimate for carrying out the proposed works?—For 20,000,000 gallons it is 317,000*l.*

6037. (*Professor Way.*) You anticipate probably a necessity for doing something with the sewage?—I think it is very probable that if other towns are compelled to move Leeds will have to move also.

6038. Is it your opinion from what you have seen that something must be done with the sewage of towns?—Yes, undoubtedly.

6039. Would the question of water supply depend in any measure upon dealing with the sewage?—I do not think it would, although it might in Leeds and in many towns.

6040. Would not that be an item in your consideration if you felt that you had to pump the sewage to which the water contributes at an annual expense every day throughout the year?—It would be, of course. If we largely increase our water supply, we shall largely increase our sewage pumping undoubtedly.

6041. And you would make your difficulties greater in dealing with it?—No question of it.

6042. Without proposing to limit your water supply below what was necessary for the town, would you not wish to keep it as low as was sufficient to enable you to deal with the sewage better?—Yes; that is one reason why I should wish to keep it low. I do not see why water should be wasted any more than bread or gas. I am at issue with those who entertain the opinion that you cannot send water too wastefully into a town. I think that you may send water much too wastefully and do no good by it, but on the contrary, harm; indeed I should be glad to see a system of meters for water introduced generally as it is for gas.

6043. (*Chairman.*) Are you acquainted with the mode of supplying water in Paris?—I have read Mr. Burnel's paper upon it.

6044. Is the cottage supply given by an internal tap or by an external stand pipe?—Partly by one

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and partly by the other. The guard taps are about to be removed, and they are gradually being put inside the houses, and our consumption is increasing partly from that cause, because when a tap is placed over a sink the temptation to waste is very great.

6045. You think that leading the water inside the house tends to a larger consumption than leaving it in the yard from which people have to fetch it?—Yes.

6046. Do you know Mr. Marten, the engineer to the Wolverhampton waterworks?—Yes, very well.

6047. He stated his experience to be the contrary. You have an external stand pipe that is not capable of being easily tampered with?—Yes, we have.

6048. Do you find that that external stand pipe is generally kept in order and not leaking?—They do leak a little at times, but our turncocks re-leather them when they require it. I do not think much water is wasted by them, not so much as when water is laid on inside the house.

6049. The kind of taps that you use the turncock who has charge of them can himself repair?—The guard taps cannot be repaired by the turncock, they have to be sent in to be repaired.

6050. Whose tap do you usually use for house service?—The screw down tap of Messrs. Guest and Chrimes, three-eighths of an inch in diameter.

6051. Do you use for the service from the main lead or iron?—Lead, invariably.

6052. For what reason do you use lead?—For one or two reasons. First, because it has always been done, and next because I should feel uneasy at the idea of using wrought iron uncoated for soft water. I remember at Wolverhampton, which you have alluded to, the very great difficulties that we had to contend with when waterworks there were first established. The water corroded the cast-iron pipes to a great extent. I fear that soft water passing along wrought iron pipes would corrode them very rapidly. I remember at Lord Robert Grosvenor's mansion at Moor Park in Hertfordshire being employed to remove a complete set of wrought iron pipes which supplied the house with soft water, and which had been so completely corroded that they were not useable; the iron spoiled the colour of the water in the baths, for cooking, and for all other purposes.

6053. Do you know whether that was a constant supply, or an intermittent supply?—It was a constant supply. The house was supplied from the reservoir in the grounds, about a quarter of a mile off, and water was kept constantly on. A further objection is that wrought iron is not flexible and not so well adapted to lay down for house supply. I think that what may be done with gas may be done with water.

6054. (*Professor Way.*) I think you stated that you thought manufacturers would use a good deal more water if it was softer than they do now?—Yes.

6055. What class of manufacturers do you refer to?—Cloth dressers. I understand that to them it is of great importance whether they have hard or soft water; it adds to the finish of the cloth after it has been through the processes of milling and finishing. I believe also soft water is good for dyeing, but for milling and finishing cloth, if hard water is used the cloth is left with an inferior feel upon it, which in the market is considered of great consequence. Soft water leaves a glossy finish upon it.

6056. What is the largest manufacturing trade in this district?—The iron trade is becoming most important, but manufacture of cloth is the staple trade of Leeds, and then the flax trade.

6057. Is tanning carried on?—Yes, and lately it has very much increased; the manufacture of boots and shoes, and the leather trade generally.

6058. With regard to pollution of the river, which of those trades do you think adds most refuse?—The iron trade, I think, does not injure the water at all except by ashes. Dyers are the worst because they throw in an immense quantity of dye wares.

6059. And tanners?—Yes, that trade is very objectionable, but I do not think the quantity of refuse that is thrown in by tanners is anything like so great as that thrown in by the dyers.

6060. I suppose in the case of tanners soft water would be of no value seeing that they use so much lime in their process?—I should imagine so.

6061. Is it your opinion that if the manufacturers in this district were prevented from polluting the water by their refuse it would be equally proper to deal with the town as to the discharge of its sewage?—Yes, I think so.

6062. Do you know which contributes most refuse to the river, the town population or the manufacturers?—I think probably that sewage does more harm than dyes.

6063. Therefore if any measure is adopted which does not deal with the sewage, the rivers will not be properly purified?—Not at all.

6064. (*Chairman.*) Are there not some large iron works a few miles out of Leeds?—Yes.

6065. What is the stream that is crossed at that point?—The Wharfe is the first river that you cross after passing through the tunnel; that, I think, is the Kirkstall Forge, and they throw an immense quantity of ashes and refuse into the river there; that is the river Aire.

6066. There is a great slag and cinder heap there parallel with the river?—Yes, and it is within the borough of Leeds.

6067. Is there not more than one establishment of ironworks there?—No, only Kirkstall Forge, but they are very large works.

6068. Who are the proprietors of those works?—Messrs. Butler and Company, the firm used to be Beecroft and Butler.

6069. You have nothing to do with the river nor with that district, I assume?—No.

6070. It does not interfere with your waterworks nor with the sewerage?—No.

6071. Is that river at all navigable?—No, it is not a navigable river; a few pleasure boats may be seen on the river at Kirkstall Abbey. The Leeds and Liverpool Canal does the navigation for the district.

6072. (*Mr. Harrison.*) You stated that the supply of water to the manufacturers from the wells had diminished of late years?—Yes.

6073. Have you any particulars to give as to that?—No figures as to it, but we know the fact by the number of manufacturers who have been obliged to come to the waterworks company for a supply in consequence of the failure of their wells.

6074. Has that arisen from the sinking of more wells?—Partly so, but chiefly from a great deal of water being pumped for the Low Moor Company out of some very deep wells at Beeston, 2,500,000 gallons a day, and we think that that is draining the district.

6075. Have you observed the quantity of water that passes down the Wharfe?—I have one or two men there, but we are not very favourably situated at Arthington for taking observations; I made one observation at Burley some years ago; I forget the particulars, but I recollect the result, that the flood had been bringing down something like 1,500,000,000 gallons a day.

6076. Would that have been a considerable flood?—Yes.

6077. Do you know the minimum quantity of water that passes down the Wharfe?—It is stated as 24,000,000 gallons of water a day, but that I have not gauged.

6078. Have you taken any gaugings in the river Aire?—None.

6079. (*Professor Way.*) Where most of the reservoirs in the hills of the district or many of them are situated the drainage area is in mossy land?—Yes.

6080. Is the water in all of them coloured with peat or at all times?—No; but all of those that I am acquainted with on the millstone grit are coloured with peat, chiefly in autumn, and after heavy rains succeeding a dry summer.

6081. You stated that you had made arrangements to carry off the peaty water?—Yes.

6082. Do you not think that if you were to drain a portion of the land on the margin of the reservoirs and on the margin of the principal feeders, so that the water should not run over the surface into the reservoirs there or into the streams, but sink into the ground there, you get rid of the peat colour?—I do not think so, because the formation of the country is not favourable to that; peat is chiefly to be found on summits of hills, the bottoms are all too well cultivated; there is grass land and some arable land. I have thought that dealing with the peat *in situ* I should not be able to face the difficulties.

6083. On peaty land the water immediately under the peat is not peaty, it is only when it comes to the surface that it becomes peaty, and therefore engineering science might devise the means of keeping the peat, which is very objectionable?—Yes.

6084. (*Mr. Harrison.*) What is the area of Wharfedale above your waterworks?—Above Arthington Mills it is about 156,000 acres or 243¾ square miles.

The witness withdrew.

Kirkby Robinson, Esq., M.D., examined.

6085. (*Chairman.*) You are officer of health for the borough of Leeds?—Yes, I have only been appointed since May last, and therefore have not any very elaborate tabulated statistics to give.

6086. How long have you been resident in Leeds?—Only since last June.

6087. Have you noticed the state of the river Aire since you have been resident here?—My attention has been frequently drawn to it, and there is no question but that it is in a very polluted state.

6088. Have you visited the outlet of the existing sewerage works?—I have not been down to the outlet.

6089. Have you examined the condition of the different becks flowing into and through Leeds?—Yes, I have seen all of them.

6090. In what condition are they?—They are all in a very polluted state, some of them are much worse than others.

6091. Have you made any detailed inspection of those parts of Leeds where zymotic diseases prevail to the greatest extent?—I have systematically gone to the localities where fever and diarrhœa have been prevalent, and I have found that disease has prevailed in those localities which are the worst drained and the most confined.

6092. Can you point out on the map the localities where you have found the greatest amount of preventible disease?—I have not had time to get together details of that nature.

6093. What has been the death rate in Leeds during last year?—For the first three quarters of the present year it was 33·8 per 1,000; it was 36·8 in the first quarter, 33·8 in the second quarter, and 31·0 for the last quarter.

6094. Is that an ordinary or a high death rate?—It is unquestionably an abnormally high death rate.

6095. Have you any returns of the death rates for any number of years preceding this year?—The rate of mortality in the township for the 10 years from 1851 to 1860, as given by the Registrar-General, was 28 per 1,000.

6096–8. What has it been for the present year up to the present time?—33·8 in the borough.

6099. If you had confined the area to the township would the mortality have been greater or less?—It would have been greater undoubtedly, but I have not got the details of it.

6100. What class of disease has prevailed this year to the greatest extent?—Fever was very prevalent in an epidemic form throughout the year. It was principally typhus fever, although there were a few cases of typhoid or enteric fever.

6101. In what class of houses did you find the greatest amount of typhus fever?—Those that I investigated were chiefly in courts contiguous to places where privies were under or close to the houses, and where there were other sanitary defects, as bad drainage and overcrowding.

6102. Have you collected any statistics as to overcrowding?—Overcrowding, no doubt, prevails in some districts of the town, but I should say not throughout the borough to the same extent as in other towns. If I take the last census in 1861 it gives something like 4·6 persons to each house.

6103. Has not there been a detailed report published by the Privy Council of an inspection that was made by Mr. Hunter some time ago in Leeds?—Yes.

6104. At what date was that?—Last year.

6105. Have you looked over that report?—Yes, I have.

6106. Have you inspected the places that he reported upon?—Yes, I have seen most of them.

6107. Do you consider that that is a reliable report?—I think it is reliable.

6108. You think it contains a fair representation of what Leeds was at that particular time?—Yes; the birth rate, I may mention, is in excess by something like 44 for the present year, and that I think suggests the possibility of the population being rather underestimated by the Registrar General.

6109. Are cleansing operations carried out pretty vigorously in Leeds, and have they been so during last summer?—Yes; additional men have been put on by the nuisance committee and these operations have been carried on far more vigorously than they were.

6110. Do you think you have observed any beneficial effects?—Certainly some of the back parts of the town present a very much cleaner aspect. The prospect of the advent of cholera caused increased vigilance in that respect.

6111. Has cholera visited Leeds in the last summer?—Not as an epidemic; there were two or three isolated cases.

6112. You succeeded in keeping it down?—Probably the low temperature and the greater amount of rain we had tended to clear the sewers and gullies and also the rivers and becks. Unquestionably all that tended to prevent that state of the atmosphere which would have favoured germination of zymotic diseases, especially diarrhœa and cholera. The isolated cases of cholera were, I believe, imported from Liverpool.

6113. Have you noticed in your investigations whether the private streets leading to this class of property are generally paved or are there many unformed or unpaved streets which are dirty in wet weather?—There are many streets which are yet unpaved, but the streets committee are now exerting themselves; they are paving the streets now as rapidly as the contractors can get through the work, but there is still a great deal to be done in that direction, not only in paving but in the extension of the drainage scheme, particularly in the out-townships and near the becks which are now open sewers in many of the out-townships, such as Bramley. They would be relieved of a great amount of filth which is now accumulating in them if the drainage scheme were extended.

6114. Are you acquainted with the water supply of Leeds?—Yes, I am; it is obtained from the river Wharfe. I think the present water is tolerably good and free from organic matter; I have not analysed it myself but I have seen recent analyses of it, and I think they can be relied on.

6115. In your investigations have you heard any complaints relative to the water supply being deficient or impure?—There has been antipathy expressed to it on account of the Otley sewage running into it; many people wishing to use water from springs and wells and particularly what they call the Spa water.

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6116. Whether rightly or wrongly you do find that the contamination of the water by the Otley sewage and other sewage is considered objectionable?—It is considered an objection.

6117. And that, I presume, would lead in a certain degree to the avoidance of it?—Yes; I think that filters are used very extensively in consequence of the fear that has been caused.

6118. Do you know the position of the gasworks in Leeds?—There are two companies and they have branch establishments, but none situated on the banks of the rivers or becks. I believe that all the ammoniacal water and the gas tar are sent into the sewers, and descend in that way into the river at the outlet.

6119. Have any complaints been made to you as to the position of those works?—There was one made not long since as to the exposure of the lime used to purify the gas, but that lime has been covered over lately.

6120. You have not had any complaints made to you?—No.

6121. Do you think that sanitary measures may be devised and carried out which would have any beneficial effect in reducing the large death rate in Leeds?—I have no doubt that if sanitary measures are vigorously prosecuted the death rate will be reduced. I believe there are existing causes which are keeping up an abnormal death rate, and there are many matters which will require time before they can be done away with. We have, for instance, something like 1,000 cellar dwellings, and we cannot turn all the people out at once before fresh dwellings are found for them, that must be a work of time; and we have in addition a vast number of privies which abut on the gable ends of the houses and cottages; there are nearly 800 actually under the dwelling rooms.

6122. Have you seen any fever cases in those rooms?—I have seen a number of cases of diarrhœa in places contiguous to them, and some cases of diarrhœa in rooms over them. Underneath there has been a privy, and the smell has been frequently complained of, and in one of the cases of Asiatic cholera I found, although there were privies at the end of the house, there was no drainage to them, and the soil was percolating through underneath; that had been frequently complained of by the people living in the basement.

6123. Would you recommend the removal of that class of privies from such situations?—I have recommended that they should all be converted into waterclosets, and the town council have given directions that notices should be served upon the proper persons for the purpose of having the privies in the worst cases converted into waterclosets.

6124. Are you put officially in communication with the inspector of nuisances?—He is to a certain extent under my control and direction, but of course he is an independent officer of the council.

6125. In the event of your finding, upon an inspection, a condition of things which, in your opinion, would cause an excess of disease, what course do you take?—The matter is brought before the nuisance and scavenging committee, and if anything is urgent, notices are at once served on the parties, that is, the owners of the property, and they are required to remedy the evil whatever it may be.

6126. In such cases do you report verbally or in writing?—Small cases I report verbally, otherwise I should report them in writing in the monthly report that I render to the nuisance committee.

6127. Does the nuisance committee meet only once a month?—They meet once a month.

6128. Is there any sub-committee that meets more frequently?—No, with the exception of the smoke committee, and that I believe meets only once a month, but the smoke inspector is authorized by the council to take proceedings without requiring the sanction of any committee.

6129. Would it not be desirable for you to be able to refer such matters to a committee at shorter intervals than once a month?—In urgent cases I communicate with the chairman if I consider it necessary.

6130. Has he authority to act alone?—He has a certain authority delegated to him by the committee, and I have no doubt that in any important matter a special meeting would be called by the chairman.

6131. Have you paid attention to the state of the public health in other parts of the country?—Yes; I was officer of health at Birkenhead for two years, prior to coming to Leeds.

6132. What was the rate of mortality in Birkenhead?—In the last year it was 21·3 per 1,000.

6133. What was the population of Birkenhead?—I estimated it at 53,000.

6134. Do you know what the mortality in Liverpool was at the same time?—About 36 per 1,000.

6135. When you were at Birkenhead it was 21·3?—Yes.

6136. Do you consider that there was anything in the atmosphere or in the sites of the dwellings to cause that great difference?—There is no doubt that the limited area of Liverpool over which a dense population is distributed would materially affect the results On the other hand, Birkenhead is comparatively a new town. There are not there the numerous courts that there are in Liverpool, with all the sanitary evils which are handed down to them, and which are to be found in Liverpool.

6137. Are you acquainted with London?—Yes.

6138. Is London as dense in population in its most crowded parts as Liverpool?—Yes, in the eastern parts of London.

6139. I mean as a whole?—Yes.

6140. And are the population as immoral?—I should say so, in the worst parts of London.

6141. Do you know what the mortality in the metropolis is?—I know that it is something like 23 per 1,000 upon an average.

6142. Do you think that there are such differences that it would be worth while to make a very searching inquiry as to why Liverpool is so exceptionally unhealthy as compared with Birkenhead, its opposite neighbour, or with London, having a far greater population?—I believe there is no doubt that Liverpool might be rendered much more healthy if vigorous sanitary measures were prosecuted.

6143. What was the mortality at the same time in Wallasey, Tranmere, or any of the adjoining townships to Birkenhead?—In Tranmere it was rather higher, in Wallasey it was low.

6144. What authority did you exercise in Birkenhead?—Birkenhead is governed by a body of commissioners, who dedicated to me the sole power to act as I thought proper in sanitary matters with the direction of the inspector of nuisances and staff under him.

6145. Is Birkenhead better sewered than Leeds?—There is no doubt of it. It is very well sewered and drained throughout.

6146. With an outlet going into the Mersey?—Yes.

6147. Is there an officer of health in Birkenhead now?—Yes.

6148. What type of disease did you find in Birkenhead in excess?—We were exposed to the frequent introduction of fever and other zymotic diseases from Liverpool. Asiatic cholera was introduced last year into Birkenhead from the ship "Helvetia."

6149. Were there many resident Irish labourers in Birkenhead?—Yes, in all parts of the town, especially in the courts and narrow streets. The Irish find employment about the docks.

6150. Was there any excess of disease amongst that population?—At one time there was, but after vigorous sanitary measures were taken there was no prevalence of any epidemic.

6151. You reduced the outbreaks of fever in those quarters?—Yes, the reduction took place in the preventible or zymotic diseases.

6152. Did you find any unwillingness on the part of the inhabitants to submit to necessary interference

with the view of cleansing their houses?—The householders and agents, as in all towns, raised objections at first.

6153. You mean the persons who had to find the money?—Yes, interested persons. They did not see the value or advantage of yielding to one of the first principles of political economy, that private interests should yield to the public good, but they afterwards yielded.

6154. Did you meet with any opposition from the inhabitants themselves?—None whatever as a body. The commissioners were anxious that all sanitary measures should be carried out thoroughly.

6155. When an epidemic of any kind prevailed had you any difficulty in getting the dead bodies removed from the crowded tenements?—We had no mortuary chapel, but I always saw that the bodies were removed at once, and when it happened that a dead body was retained I communicated with the parochial authorities, and had it removed at their expense to prevent the retention of it in the house.

6156. Had you any difficulty with the Irish, who always desire to wake their dead?—We had a certain amount of difficulty, but by offering to inter their dead gratuitously we generally overcame their objection.

6157. The river Mersey containing an enormous volume of tidal water, did you observe any foulness in it from the sewage of Birkenhead?—No; there was at times along the banks of the river at low water a certain amount of sullage, but not to any great extent so as to give off any bad odours.

6158. Were complaints ever made by steamboat passengers or any other persons passing along the river?—No, and the people bathe along the banks constantly.

6159. No difficulty arose as to the pouring out of the sewage into the river?—No, I think it was deodorised sufficiently to counteract that, and it was carried away by the tides. Then we had the sewers ventilated through charcoal baskets after I went there, for sometimes the tide when it rose had driven back the gases, and that had been complained of in the houses. I then brought the matter before the commissioners, and the sewers were ventilated on Stenhouse's plan through charcoal baskets.

6160. How many ventilators were put on to the sewers?—I have no record of the number, but they were introduced systematically whenever a sewer was opened.

6161. Were the sewers in Liverpool ventilated on a similar plan?—In some parts of the town they were ventilated by chimney shafts, but not to any very great extent. They were not ventilated through charcoal baskets.

6162. Were they ventilated as well as at Birkenhead?—Not in anything like the same proportion.

6163. Do you attribute any excess of disease to the want of ventilating the sewers?—Yes. When I have gone into a house where zymotic disease has prevailed there have been great complaints made of the effluvium which has risen through the traps, and the frequency with which it was let out in cottage dwellings caused the houses to be filled with bad gases.

6164. If the sewers had been ventilated externally there would have been less of that?—Yes. The more sanitary measures are carried out the more perfect should the details be.

6165. (*Mr. Harrison.*) Can you give me the death rate in Leeds for some years past year by year?—In the township of Leeds the death rate for five years, from 1860 to 1864, was 29·5. The death rate in the township for 10 years, from 1851 to 1860, was 28 per 1,000.

6166. Have you observed any ill effects of the river Aire upon the health of the population?—I should say there is no question that in dry seasons the atmosphere must be contaminated to a great extent by the gases which arise from the polluted banks, and that has been complained of very much. In cases where parties have been prosecuted for private nuisances the officials have been taunted with the state of the becks and the river.

6167. Have you been able to attribute any disease directly to the condition of the becks and river?—No.

6168. I think you stated that at Birkenhead the sewage was carried away by the tide?—Yes.

6169. Can you say whether the tide sets in there in the same direction on the flood and on the ebb tide?—It does not set in in the same direction.

6170. So that the sewage is carried away from the outlet, and is not brought back by the returning tide?—Yes, it would be returned on the other side, if at all.

6171. That might account for your not finding any nuisance from the sewage in a tidal river?—Yes, and perhaps much also depends upon the direction of the wind.

The witness withdrew.

Mr. Alfred Mountain Fowler (Leeds) examined.

6172. (*Chairman.*) You are the Borough Surveyor of Leeds?—Yes.

6173. How long have you held that appointment?—About 16 months.

6174. Who was borough surveyor before you?—Mr. Filliter, who has been examined.

6175. He is now acting with you as consulting engineer?—Yes; under an Act of Parliament which empowers the corporation to have a consulting engineer for the sewerage works.

6176. You can therefore avail yourself of his experience when you think proper?—Exactly so.

6177. What is the area of the borough of Leeds?—It is about 34 square miles, which is represented by the part tinted brown on the cartoon map before you.

6178. How many different townships does that area comprise?—There are 12 townships and three divisions of townships. The divisions are Headingley, Cam, Burley, and Kirkstall, in the township of Headingley, and also Culcoates in the township of Patternewton.

6179. The local government of Leeds has been recently consolidated I believe by Act of Parliament?—Yes.

6180. How many local governing bodies were there before this year?—15 as far as highways are concerned.

6181. All these have been swept away, and are consolidated now under the Corporation?—Yes.

6182. What is your present population within the borough?—About 228,000 within the municipal borough; that is what the Registrar General has returned.

6183. What number of tenements or houses have been erected during the last five years?—Something like 5,127.

6184. May it be said that Leeds is a growing district?—Yes, no doubt of it; it is growing very rapidly.

6185. What is the rateable value of Leeds now?—According to a return that I got out last year it was 593,778*l.* 19*s.* 1*d.*

6186. It will not be less now I suppose?—No, but considerably more; I should say that the town has increased very rapidly in the last 12 months.

6187. What length of public highways have you now under your jurisdiction?—We shall have now about 133 miles.

6188. About what length of main sewerage and drainage is there?—The sewerage system is now nearly completed, and the corporation have given me

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instructions to prepare designs for the whole borough, beginning with Bramley. Already there are about 94 miles of main sewers.

6189. What has been the gross cost of the main sewerage and drainage?—The cost has been about 180,000*l.*

6190. What are the dimensions of the largest sewer upon the cross section?—Our main outfall sewer is 7 feet 9 by 8 feet.

6191. Is it an egg-shaped invert, or a flat?—It has a slight curve.

6192. It is a segmental invert?—Yes.

6193. What is the volume of sewage that is discharged per day?—I gauged it yesterday, and the discharge in cubic feet per minute is something like 1,271½.

6194. Are there not a number of becks that pass through the town?—Yes.

6195. What are their names, taking the largest area?—There is the Sheepscar Beck and the Holbeck.

6196. The Holbeck area is 14,900 acres partly within and partly without the borough is it not?—Yes.

6197. The Sheepscar Beck has an area of 11,320 acres partly within and partly without the borough?—Yes.

6198. Then the Barm Beck and the Dow Beck have an area of 2,080 acres partly within and partly without the borough?—It is so.

6199. Are these the only becks that flow into and through Leeds?—The red marks on the map show the gathering ground for these particular becks, and they have several tributaries, of course, which have other names. I have taken the names of the main trunks.

6200. Is there much sewage passed into these becks?—Yes, a great quantity.

6201. Is there much passed into the becks beyond the boundary of the borough?—There is a little; but I have not examined minutely beyond the borough.

6202. Is there a town at Morley?—There is a very large village there, and I think they have a local board.

6203. Then there is Gildersome?—Yes.

6204. It that a small village?—Yes.

6205. What is the other below it?—Birstal.

6206. Is that a village?—Yes.

6207. Does any sewage from those villages find its way into the different becks, and flow on to Leeds?—Yes; unless they distribute it over the land. Beeston is not in our drainage district, but it is within the borough of Leeds; it has a system of sewers, but whether it is drained by the vestry or not I cannot say. It empties itself into the lower stream on the left-hand, and then it goes forward into the Wortley Beck, and passes through the town to a certain extent.

6208. If in Leeds you were to carry out the most perfect system of interception for yourselves, in order to prevent contamination within the borough, and you had no jurisdiction beyond the boundary of the borough, the stream might be contaminated by all those places lying outside the borough?—Of course that would be so.

6209. Therefore, unless your jurisdiction should come down to the edge of the drainage area, you would be purifying your own streams, and be subject to impurities caused by persons outside?—Yes; from those small villages. Morley is rather an extensive village I believe.

6210. Are those places growing?—I think that Morley is, but I have not noticed the census returns.

6211. Are there any collieries under that part of the watershed to which you have referred?—Yes, and iron mines.

6212. Where does the water that is pumped from the mines pass, does it go down into the becks?—It would pass out, and ultimately get into the Holbeck.

6213. Have you prepared any list of the manufactories situated on these becks and rivers within the watershed areas, or within the area of the borough of Leeds?—I have prepared a list of the principal manufactories with the number of hands that each firm employs, to give you an idea of the extent of each establishment. (*The return will be found printed at the foot of the evidence of the witness.*)

6214. How did you obtain that?—I prepared it with assistants in my own office; they obtained the information on the ground from inquiries made from time to time.

6215. Has that return been laid before the town council or before the board?—No.

6216. (*Professor Way.*) Did the manufacturers themselves furnish you with the particulars of these returns?—Yes, or their assistants.

6217. They knew what the object of making the inquiry was?—No doubt of it.

6218. Do you know whether any refuse from any of these manufactories is utilized in any way or purified before the waste material is passed into the streams?—I do not know.

6219. If it is not so purified, I suppose it is passed into the nearest stream or sewer, and then it goes into the river?—Exactly.

6220. I believe that at the dyeworks they pass the dye water into the becks?—I believe they do.

6221. It may be seen there may it not?—Yes, in large quantities at times.

6222. And tan refuse also?—I have not examined minutely the tan yards, and I cannot say for a certainty whether they pass any refuse into the stream.

6223. Do you know the length of the river from Malham Tarn to its junction with the Calder?—It is about 54½ miles.

6224. What is the area of the gathering ground?—About 350 square miles, that is the area above the sewer's outfall.

6225. What is the length of the Sheepscar Beck?—That is about 9 miles and 6 furlongs, taking the stream along the valley.

6226. What is the length of the Holbeck?—About 11 miles and 1 furlong.

6227. What is the length of the Barm Beck?—About 2 miles and 3 furlongs, and the Dow Beck is about half a mile; the Bengon Beck is 7 furlongs, and that is covered.

6228. Has there been any systematic cleansing of the rivers or becks through Leeds since your appointment?—No, but they have been cleansed out several times by the Corporation.

6229. What kind of manufactures give the greatest amount of impurity?—I should say dyeworks.

6230. With regard to the discolouration of the water?—Yes. If the tanyard people sent their refuse into the river, no doubt they would cause also very great nuisances.

6231. Have you noticed whether any of the iron makers send ashes into the streams or rivers?—I have not.

6232. Have you noticed the state of the river during very dry seasons?—Yes, but the river Aire has so many dams on its course through the town; there are nine or 10 weirs and dams, and you do not see the bed of the river except very seldom.

6233. Has it been proposed to improve the condition of the becks passing through the town?—Yes, the corporation have sought for further powers in their Improvement Bill of this year to enable them to cover them in, or invert them as is done in Lancashire.

6234. They wall the sides where they are unprotected and pave the channels?—Yes, they so invert them that they increase the velocity of the stream.

6235. Have you seen the improvements which have been carried out in Blackburn and Bolton ?—No, I have not.

6236. Is there much sewering going on now ?—Yes, a great quantity.

6237. Where are the outlets made ?—Into the existing system which was designed by Mr. Leather, passing on to the main outfall, where you see that dark branch on the large map on the right-hand side, that is some 57 feet above the Ordance datum line, and the figures "50" show where the 50 feet contour crosses the river.

6238. Then you have 7 feet of fall between the 57 and the 50 ?—Yes.

6239. Have you any control over the introduction of sewage from waterclosets into any of the drains or sewers ?—No, the waterclosets are connected with the sewers.

6240. If any person occupying any offices or buildings of any kind, or cottages, wishes to convert the privies into waterclosets, must he give you notice ?—Yes, and he must give the officer of health notice also.

6241. Have you cognizance of any such application being made ?—Not necessarily so. I do not know that they often do it, except the officer of health compels them to alter the state of the privies. For instance, where there are buildings over privies, in such cases the privies are converted into waterclosets.

6242. Do you allow the parties to do the work, or do you do it for them, and charge them the cost ?—No, they do it themselves.

6243. Have you no establishment or staff for the purpose of carrying out that kind of work for the ratepayers ?—None whatever. The only difficulty that we have is, where these old privies exist in confined courts and alleys, we then have a difficulty in finding them a place instead of the existing privy; sometimes we find that bedrooms are built over privies, and it is necessary to remove them.

6244. Do you think that the owners can carry out these alterations as economically as you could if you had a staff of men to employ for that special purpose ?—I think so, because the places are so small, and the expense would not amount to much.

6245. Do you superintend the work while it is in progress ?—Only with reference to the Act as to the size of the waterclosets. The Act empowers us to have them made 3 feet wide, 5 feet long, and 7 feet high.

6246. Do you dictate the size of the connecting drain ?—Yes.

6247. Then as to the junction with your own sewer, do you allow the parties to make that, or do you do it ?—They put in the first pipe, but we examine the connexion.

6248. Do they pay you for being allowed to put it in ?—No.

6249. Have you found many stoppages in private drains ?—Yes, where the work has been done privately. I do not know of any cases in works done by the corporation.

6250. You do find stoppages occasionally ?—Yes.

6251. (*Mr. Harrison.*) I believe Bramley is within the borough of Leeds ?—Yes.

6252. Is Bramley sewered ?—No, it is not.

6253. What is the condition of the village of Bramley as to health ?—The death rate I have not noticed; I should know nothing of that. The officer of health could answer that question. The state of the sewerage is bad.

6254. But Bramley is within the limits of the borough ?—Yes.

6255. And the sewerage you know is bad ?—Yes. Most of it runs on to the surface; for instance, from the sink stones. I may mention that the corporation have passed a resolution giving me instructions to draw out plans and a design for this district, on the south side of the river, to connect the same with our system of sewerage.

6256. Have you looked into the question of applying sewage to land ?—No, not as yet.

6257. You have not taken any levels of the meadows below your outfall ?—No, I have not gone into that question; but there is a resolution of the council giving instructions to me and the engineer to report as to the best means of utilizing sewage, or what can be done to purify the river below the sewers outfall. The dark tint on the map shows the present drainage district, with the district and parish of St. John's, Wortley, which is a district that we have lately added. The Wortley and Holbeck sewers, as shown there, have been designed by me, and they are before the engineer for him to certify.

6258. (*Professor Way.*) In case of any additional sewerage for the town of Leeds being carried out, should you be likely to take the outfall to the same place for the additional work ?—I think that by constructing storm outlets to our present system, we can connect the whole borough with our present system.

6259. Would the application of the sewage to land be less or more difficult if the sewage were all discharged at one spot ?—That is a question that I should say must depend upon the quantity of land you had below the sewer's outfall.

6260. Supposing that the land is to be the destination of the sewage, that would make a difference in your view as to any future sewerage of the town ?—Yes.

The witness withdrew.

RETURN put in by A. M. FOWLER, Esq., C. E., Borough Surveyor (referred to supra, Qu. 6213).

RIVER AIRE.

Name of Works or Street.	Name of Occupier.	Chemical Works.	Cloth Dressers or Finishers.	Dyers.	Woollen Manufacturers.	Tanners or Curriers.	Iron Workers.	Waste or Mongo Dealers.	Worsted Manufacturers.	Glue Works.	Linen Manufacturers.	Flax Spinners.	Paper Mills.	Oil Mills.	Corn Mills.	Saw Mills.	Miscellaneous.	Remarks upon solid Refuse.
1. Kirkstall Road	Alderman Botterill	—	—	275	—	—	—	—	—	—	—	—	—	—	—	—	—	
2. Aire Place Mill, Kirkstall Road.	W. E. R. Walker	—	—	—	—	—	—	20	—	—	—	—	—	—	—	—	—	
3. Wellington Tannery, Kirkstall Road.	T. Talbot	—	—	—	—	24	—	—	—	—	—	—	—	—	—	—	—	
4. Kirkstall Road	Whitham and Son	—	—	—	—	—	600	—	—	—	—	—	—	—	—	—	—	Use Privies connected with River.
5. Kirkstall Road	— Robinson	—	—	—	—	—	—	—	—	—	120	—	—	—	—	—	—	
6. Armley Mills	Benjamin Gott and Sons	—	—	—	100	—	—	—	—	—	—	—	—	—	—	—	—	
7. Burley Mill	W. B. Holdsworth and Co.	—	—	—	—	—	—	—	—	—	420	—	—	—	—	—	—	
8. Abbey Mill, Kirkstall	James Webster and Son	—	—	—	300	—	—	—	—	—	—	—	—	—	—	—	—	
9. Bentley's Wharf, Water Lane	S. Bentley and Son	—	—	—	—	—	—	12	—	—	—	—	—	—	—	—	—	
10. Water Lane	W. S. Shepherd	—	—	—	—	—	—	15	—	—	—	—	—	—	—	—	—	
11. Bowman Lane Dye Works	William Kitchen	—	—	30	—	—	—	—	—	—	—	—	—	—	—	—	—	
12. Clarence Iron Works	Taylor Brothers and Co.	—	—	—	—	—	500	—	—	—	—	—	—	—	—	—	—	
13. Victoria Chemical Works, South Accommodation Road.	William Armitage	31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
14. Airedale Felt Works, South Accommodation Road.	Wilkinson and Fillingham	—	—	—	3	—	—	—	—	—	—	—	—	—	—	—	—	
15. Airedale Chemical Works	Hirst Brooke and Tomlinson	14	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Privies connected with River.
16. Hunslet Mills	Messrs. Wilkinson and Co.	—	—	—	—	—	—	—	—	—	—	1,500	—	—	—	—	—	
17. Water Mills	Messrs. Wilkinson and Co.	—	—	4	—	—	—	—	—	—	—	—	—	—	—	—	—	
18. Hunslet Low Road	Messrs. Varley and Sidgwick	—	—	—	—	—	6	—	—	—	—	—	—	—	—	—	—	
19. Hunslet Paper Mills	Hastings and Mellor	—	—	—	—	—	—	—	—	—	—	—	120	—	—	—	—	
20. Low Gate Mills	Lister Brothers and Co.	—	—	—	—	—	—	—	200	—	—	—	—	—	—	—	—	Privies connected with River.
21. Sovereign Street	Titley, Tatham, and Walker	—	—	—	—	—	—	—	200	—	—	—	—	—	—	—	—	
22. Ditto	Benjamin Stocks and Son	—	—	—	—	—	—	—	—	—	—	—	50	—	—	—	—	
23. Wellington Mill, Wellington Bridge Street	Messrs. Hirst and Whitehead	—	—	100	—	—	—	—	—	—	—	—	—	—	—	—	—	
24. Sovereign Street	Wild and Crossley	—	—	—	—	—	36	—	—	—	—	—	—	—	—	—	—	
25. Ditto	Ellershaw and Sons	—	—	—	—	—	—	—	—	—	—	—	—	14	—	—	—	
26. Off Sovereign Street	George and Richard Mortimer	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	150	
27. Tenter Lane	Moorhouse and Thistlewaite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	20	
28. Tenter Lane	Robert Hudson and Co.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	100	
29. Flay Crow Mills, off Tenter Lane.	John Dyson	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	21	
		45	—	409	403	24	1,142	47	400	—	540	1,500	170	14	—	—	291	

Number of Hands carried forward.

RETURN put in by A. M. FOWLER, Esq., C.E., Borough Surveyor (referred to supra, Qu. 6213).

RIVER AIRE—*continued.*

Name of Works or Street.	Name of Occupier.	Chemical Works.	Cloth Dressers or Finishers.	Dyers.	Woollen Manufacturers.	Tanners or Curriers.	Iron Workers.	Waste or Mongo Dealers.	Worsted Manufacturers.	Glue Works.	Linen. Manufacturers.	Flax Spinners.	Paper Mills.	Oil Mills.	Corn Mills.	Saw Works.	Miscellaneous.	Remarks upon solid Refuse.
	Brought over -	45	—	409	403	24	1,142	47	400	—	540	1,500	170	14	—	—	291	
30. Neville Street - -	— Nussey - -	—	—	30	—	—	—	—	—	—	—	—	—	—	—	—	—	
31. Neville Street - -	W. Pearson and Co. -	—	—	—	100	—	—	—	—	—	—	—	—	—	—	—	—	
32. Sandford Street - -	Thomas W. Appleyard -	—	—	—	—	70	—	—	—	—	—	—	—	—	—	—	—	
33. Airedale Saw Works, Kirkstall Road.	— Bulmers - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	11	—	
34. Whitehall Road - -	George Leach and Co. -	—	225	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
35. Whitehall Engineering Works.	Gallon, Lumb, & Co. and others	—	—	—	—	—	200	—	—	—	—	—	—	—	—	—	—	
36. Park Mills, Wellington St.	Benjamin Gott and Sons	—	—	—	700	—	—	—	—	—	—	—	—	—	—	—	—	
37. Wellington Mill, Wellington Bridge Street.	D. and T. Cooper and another	—	500	—	—	—	—	—	—	—	—	—	—	—	—	—	—	170 hands use privies connected with River.
38. Wellington Foundry, Kirkstall Road.	Messrs. Fairburn and Co.	—	—	—	—	—	2,000	—	—	—	—	—	—	—	—	—	—	
39. Airedale Mill, Kirkstall Rd.	— Glover - -	—	33	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
40. Kirkstall Road - -	Messrs. Musgrave -	—	—	20	—	—	—	—	—	—	—	—	—	—	—	—	—	
41. Kirkstall Road - -	William Walker -	—	—	38	—	—	—	—	—	—	—	—	—	—	—	—	—	
42. Kirkstall Road - -	— Fawcett - - -	—	—	8	—	—	—	—	—	—	—	—	—	—	—	—	—	Privies connected with River.
43. Kirkstall Road - -	Eli Dalton - -	—	—	12	—	—	—	—	—	—	—	—	—	—	—	—	—	
44. Aire Tannery, Kirkstall Rd.	Messrs. Walker & Dixon	—	—	—	—	30	—	—	—	—	—	—	—	—	—	—	—	
45. Kirkstall Road - -	— Wilkinson - -	—	—	—	—	—	—	—	100	—	—	—	—	—	—	—	—	
46. Kirkstall Road - -	— Padgett - -	—	—	—	253	—	—	—	—	—	—	—	—	—	—	—	—	
47. Kirkstall Road - -	— Topham - -	—	—	70	—	—	—	—	—	—	—	—	—	—	—	—	—	
48. Savings Mill, Kirkstall Rd.	Thomas Gray - -	—	—	—	25	—	—	—	—	—	—	—	—	—	—	—	—	
49. Kirkstall Forge - -	Messrs. Butter and Co. -	—	—	—	—	—	1,500	—	—	—	—	—	—	—	—	—	—	
50. Airedale Dye Works, Kirkstall Road.	Hague and Billington -	—	—	300	—	—	—	—	—	—	—	—	—	—	—	—	—	
51. Newlay - - - -	Clarke, Thackray, & Co.	—	—	—	—	—	—	—	20	—	—	—	—	—	—	—	—	
52. Newlay - - - -	Messrs. Tunstall Brothers	12	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
53. Newlay - - - -	Priestman - -	—	—	—	—	—	—	—	—	—	—	—	—	—	8	—	—	
54. Victoria Mill - -	Peter Willans - -	—	100	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
55. Kirkstall Road - - -	Messrs. Wood & Bedford	16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
56. Horsfall Dye Works, Kirkstall Road.	Frederick Blackburn -	—	100	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Privies connected with River.
57. Kirkstall Road - -	Reffitt and Co. - -	—	224	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
58. Kirkstall Road - -	T. W. George and Co. -	—	150	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
59. Joppa Tannery, Kirkstall Rd.	Richard Nichols - -	—	—	—	—	00	—	—	—	—	—	—	—	—	—	—	—	120 men use privies connected with River.
		73	1,332	887	1,481	424	4,842	47	520	—	540	1,500	170	14	8	11	291	

Number of Hands carried forward.

RETURN put in by A. M. FOWLER, Esq., C.E., Borough Surveyor (referred to supra, Qu.6213).

RIVER AIRE—*continued.*

Name of Works or Street.	Name of Occupier.	Chemical Works.	Cloth Dressers or Finishers.	Dyers.	Woollen Manufacturers.	Tanners or Curriers.	Iron Workers.	Waste or Mongo Dealers.	Worsted Manufacturers.	Glue Works.	Linen Manufacturers.	Flax Spinners.	Paper Mills.	Oil Mills.	Corn Mills.	Saw Mills.	Miscellaneous.	Remarks upon solid Refuse.
	Brought over - -	73	1,332	887	1,481	424	4,842	47	520	—	540	1,500	170	14	8	11	291	
60.	Thomas Smith - -	—	—	—	—	—	12	—	—	—	—	—	—	—	—	—	—	
61. Off East Street -	James Smith - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6	
62. Swinegate - -	William M'Clean -	—	—	3	—	—	—	—	—	—	—	—	—	—	—	—	—	
63. Calls - -	Palmer and Wyles -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	12	
64. East Street - -	William Brayshaw and Sons.	—	—	19	—	—	—	—	—	—	—	—	—	—	—	—	—	
65. Fearne's Island -	Musgrave Brothers -	—	—	15	—	—	—	—	—	—	—	—	—	—	—	—	—	
66. Ditto -	Croysdale Brothers -	—	—	60	—	—	—	—	—	—	—	—	—	—	—	—	—	
67. Ditto -	S. D. Dixon and Sons -	—	—	12	—	—	—	—	—	—	—	—	—	—	—	—	—	Privies connected with River.
68. Ditto -	Josh. Waddington -	—	—	12	—	—	—	—	—	—	—	—	—	—	—	—	—	Privies connected with River.
69. Bank Mills, East Street	Ives and Atkinson -	—	—	—	—	—	—	—	—	—	—	1,400	—	—	—	—	—	30 men use privies connected with River.
70. East Street - -	Joshua Briggs - -	—	—	—	—	16	—	—	—	—	—	—	—	—	—	—	—	
71. Low Fold Mills -	Thompson, Watson, and White.	—	—	—	—	32	—	—	—	—	—	—	—	—	—	—	—	6 men use privies connected with River.
72. East Street - -	John Ramsden's executors	—	—	5	—	—	—	—	—	—	—	—	—	—	—	—	—	
73. York Street Mills -	John Purchon - -	—	60	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
74. Low Fold Mills -	Hartley and Turner -	—	—	—	40	—	—	—	—	—	—	—	—	—	—	—	—	
75. Ditto -	Messrs. Hartley and Co. -	—	—	—	95	—	—	—	—	—	—	—	—	—	—	—	—	
76. Low Fold, off East Street.	Greenwood and Battey -	—	—	—	—	—	250	—	—	—	—	—	—	—	—	—	—	
77. Ablon Foundry, off East Street.	Garside and Sons -	—	—	—	—	—	22	—	—	—	—	—	—	—	—	—	—	
78. Low Fold Mills -	Brown, Rhodes, and Co. -	—	—	—	50	—	—	—	—	—	—	—	—	—	—	—	—	
79. Ditto -	J. Carter - -	—	—	—	15	—	—	—	—	—	—	—	—	—	—	—	—	
80. Ditto -	John Laycock - -	—	7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
81. Ditto -	J. Booth and Sons -	—	—	—	20	—	—	—	—	—	—	—	—	—	—	—	—	
82. Ditto -	Ellis and Whitaker -	—	—	—	30	—	—	—	—	—	—	—	—	—	—	—	—	
83. Kings Old Mills, Swinegate.	Rushworth Brothers -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	15	
84. Victoria Mill - -	Roger Shackleton and Sons	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	10	
85. School Close Mill -	J. and W. Whiteley -	—	—	—	200	—	—	—	—	—	—	—	—	—	—	—	—	
86. Bishopgate Street -	Hirst, Brook, & Tomlinson	40	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
		113	1,399	1,013	1,931	472	5,126	47	520	—	540	2,900	170	14	8	11	334	

Total number of Hands, 14,598.

RETURN put in by A. M. FOWLER, Esq., C.E., Borough Surveyor (referred to supra, Qu. 6213)—*continued.*

SHEEPSCAR BECK.

Name of Works or Street.	Name of Occupier.	Chemical Works.	Cloth Dressers and Finishers.	Dyers.	Woollen Manufacturers.	Tanners or Curriers.	Flax Spinners.	Iron Workers.	Mongo Dealers.	Glue Works.	Linen Manufacturers.	Corn Mill.	Saw Mill.	Oil Mill.	Silk Spinning.	Remarks on solid Refuse.
87. Bank Low Mills, Mill Street	James Holdforth and Sons	—	—	—	—	—	—	—	—	—	—	—	—	—	450	
88. Worsted Street - -	Edward Wilson - -	—	—	4	—	—	—	—	—	—	—	—	—	—	—	
89. Grace Street Mill - -	Wright Brothers -	—	5	—	—	—	—	—	—	—	—	—	—	—	—	
90. Duke Street - -	John Westbrook - -	—	—	—	—	—	—	20	—	—	—	—	—	—	—	
91. Providence Spindle Works	Rathbone and Crabtree -	—	—	—	—	—	—	30	—	—	—	—	—	—	—	
92. Hope Foundry, Mabgate -	Samuel Lawson and Sons	—	—	—	—	—	—	1,300	—	—	—	—	—	—	—	
93. Mabgate Mill - -	Joseph Broadhead -	—	—	—	—	—	—	—	—	—	—	4	—	—	—	
94. Mabgate Mills - -	John Morfitt - -	—	—	—	—	—	400	—	—	—	—	—	—	—	—	
95. Cherrow Row, Mabgate -	William Dickinson -	—	—	—	—	—	—	20	—	—	—	—	—	—	—	
96. Mushroom Street, New Town.	Walker, Quickfall, and Co.	8	—	—	—	—	—	—	—	—	—	—	—	—	—	
97. Low Close Mill, New Town	Hardwick Brothers -	—	120	—	—	—	—	—	—	—	—	—	—	—	—	
98. Sheepscar Dyeworks -	Holroyd and Co. - -	—	—	140	—	—	—	—	—	—	—	—	—	—	—	
99. East Street, No. 53 -	John Crawford and Sons	—	150	—	—	—	—	—	—	—	—	—	—	—	—	
100. Sheepscar Foundry -	John Hezmalhalch and Sons.	—	—	—	—	—	—	20	—	—	—	—	—	—	—	
101. Sheepscar Chemical Works	William Watson and Co. -	11	—	—	—	—	—	—	—	—	—	—	—	—	—	
102. Sheepscar Works - -	Wilson and Walker -	—	—	—	—	—	—	—	—	250	—	—	—	—	—	
103. Buslingthorpe Tannery -	W. L. Jackson - -	—	—	—	—	90	—	—	—	—	—	—	—	—	—	
104. Buslingthorpe Works -	James Stanilands Stocks and Co.	—	—	—	—	108	—	—	—	—	—	—	—	—	—	
105. Springwell Works -	James J. Flitch and Sons	—	—	—	—	120	—	—	—	—	—	—	—	—	—	
106. Grove Mill, off Meanwood Road.	George Walker and Sons	—	—	—	—	—	—	—	—	—	40	—	—	—	—	
107. Grove Dyehouse - -	Lee and Sharp - -	—	—	20	—	—	—	—	—	—	—	—	—	—	—	
108. Meanwood Tannery -	William and Samuel Smith	—	—	—	—	60	—	—	—	—	—	—	—	—	—	
109. Weetwood Paper Mill (formerly).	William Hill - -	—	—	—	—	—	—	—	—	—	12	—	—	—	—	
110. Meanwood Tannery -	Edward Kitchen -	—	—	—	—	15	—	—	—	—	—	—	—	—	—	
111. Dolphin Foundry, Steander	Thomas Campbell and Sons	—	—	—	—	—	—	90	—	—	—	—	—	—	—	
112. Steander Mills, off East Street.	Messrs. Leadley - -	—	—	—	100	—	—	—	—	—	—	—	—	—	—	
113. 17, East Street -	John Ramsden - -	—	—	7	—	—	—	—	—	—	—	—	—	—	—	
114. East Street -	James Bradley - -	—	—	—	—	—	—	8	—	—	—	—	—	—	—	
115. Crown Point Axle Works	James Leach and Co. -	—	—	—	—	—	—	6	—	—	—	—	—	—	—	
		19	275	171	100	393	400	1,494	—	250	52	4	—	—	450	
		Number of Hands carried forward.														

RETURN put in by A.M. FOWLER, Esq. C.E. Borough Surveyor (referred to supra, Qu. 6213).

SHEEPSCAR BECK—*continued.*

Name of Works or Street.	Name of Occupier.	Chemical Works.	Cloth Dressers and Finishers.	Dyers.	Woollen Manufacturers.	Tanners and Curriers.	Flax Spinners.	Iron Workers.	Mongo Dealers.	Glue Works.	Linen Manufacturers.	Corn Mills.	Saw Mills.	Oil Mills.	Silk Spinners.	Bone Mills.	Remarks on solid Refuse.
	Brought forward -	19	275	171	100	393	400	1,494	—	250	52	4	—	—	450	—	
116. Albert Mills - -	J. D. Thorpe - -	—	—	—	—	—	—	—	—	—	—	15	—	—	—	—	
117. Harper Street - -	Thomas Hall and Co. -	—	—	—	—	—	—	—	—	—	—	—	80	—	—	—	
118. Mill Garth Mills, Dyers Street.	Alfred Robinson	—	—	—	400	—	—	—	—	—	—	—	—	—	—	—	
119. Mill Garth Mills - -	Thomas Smith and Sons -	—	—	—	40	—	—	—	—	—	—	—	—	—	—	—	2 drop privies.
120. Ditto Mill Garth Street.	J. T. Fleck - -	—	—	—	70	—	—	—	—	—	—	—	—	—	—	—	
121. Lady Bridge Mill -	Benjamin Snell and Co. -	—	—	—	200	—	—	—	—	—	—	—	—	—	—	—	
122. Lady Bridge Iron Works -	Joseph Binns and another	—	—	—	—	—	—	4	—	—	—	—	—	—	—	—	
123. 45, Templar Street -	J. T. Pearson - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	12	
124. Byron Street Mill - -	Charles Atkinson -	—	—	—	—	—	—	—	—	—	170	—	—	—	—	—	
125. Skinner Lane Works -	J. F. Stead - -	—	—	—	—	—	—	—	—	—	90	—	—	—	—	—	
126. Ditto -	Crowther and Co. -	12	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
127. Providence Works, Stamford Street.	Mark Richardson and Co.	—	—	—	—	—	—	13	—	—	—	—	—	—	—	—	
128. Ditto ditto -	William Richardson -	—	—	—	—	10	—	—	—	—	—	—	—	—	—	—	1 drop closet.
129. Sheepscar Works, Barclay Street.	Broadhead and Sons -	—	—	—	—	—	—	—	—	—	—	—	—	10	—	—	
130. Sheepscar Foundry -	John Hezmalhalch & Sons	—	—	—	—	—	—	20	—	—	—	—	—	—	—	—	
131. Sheepscar - -	Stead and Simpson -	—	—	—	—	60	—	—	—	—	—	—	—	—	—	—	
132. Sheepscar Tannery	Ditto -	—	—	—	—	95	—	—	—	—	—	—	—	—	—	—	
133. Sheepscar Mill - -	J. Ripley and Son -	—	—	—	50	—	—	—	—	—	—	—	—	—	—	—	
134. Oatlands Mill - -	Edward Taylor and Son -	—	—	—	200	—	—	—	—	—	—	—	—	—	—	—	
135. Prussiate Works, Woodhouse Carr.	William Foster -	16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
136. Carr Mills, Buslingthorpe -	Wrights and Bayles -	—	50	—	—	—	—	—	—	—	—	—	—	—	—	—	
137. Ditto -	Benjamin Wood - -	—	3	—	—	—	—	—	—	—	—	—	—	—	—	—	
138. Ditto -	J. L. Clarkeson - -	—	—	3	—	—	—	—	—	—	—	—	—	—	—	—	
139. Ditto -	George Dixon - -	—	—	10	—	—	—	—	—	—	—	—	—	—	—	—	
		47	328	184	1,060	558	400	1,531	—	250	312	19	80	10	450	12	

Total number of Hands, 5,241.

RETURN put in by A. M. FOWLER, Esq., C.E., Borough Surveyor (referred to supra, Qu. 6213).

HOLBECK.

Name of Works or Street.	Name of Occupier.	Cloth Manufacturers, or Dressers.	Dyers.	Woollen Manufacturers.	Tanners and Curriers.	Flax Spinners.	Iron Workers.	Linen and Cotton Manufacturers.	Corn Mills.	Saw Mills.	Miscellaneous.	Remarks.
140. Water Hall Mills	Titley, Tatham, and Walker	—	—	—	—	250	—	—	—	—	—	
141. Ditto	Armisted and Company	—	—	—	—	—	—	—	—	—	40	
142. Holbeck New Mills	George Lockwood	80	—	—	—	—	—	—	—	—	—	
143. Ditto	Joseph Barrett	—	—	23	—	—	—	—	—	—	—	
144. Ditto	Walker and Chadwick	—	—	50	—	—	—	—	—	—	—	
145. Britannia Mill, Holbeck Lane	Benjamin Mortimer and Sons	—	—	—	—	—	—	—	9	—	—	
146. Star Foundry, Wortley Lane	Charles Cluderay	—	—	—	—	—	13	—	—	—	—	
147. Wellington Mill, ditto	Seanor and Company	—	—	—	—	—	—	—	—	—	45	
148. Royd's Mill, Wortley Beck	Pearce, Ellis, and Trippleton	—	—	25	—	—	—	—	—	—	—	
149. Walker Mill	George Brown	—	—	—	—	—	—	140	—	—	—	
150. Wortley Saw Mill	Daniel Hinchcliffe and Co.	—	128	—	—	—	—	—	—	—	—	
151. Farnley Saw Mill	Hargreave and Nussy	—	40	—	—	—	—	—	—	—	—	
152. Stone Bridge Works	Porson and Co.	—	214	—	—	—	—	—	—	—	—	
153. Stone Bridge Mill, Armley	Francis Halliday	—	30	—	—	—	—	—	—	—	—	
154. Farnley Corn Mill	Clough Brothers	—	—	—	—	—	—	—	4	—	—	
155. Hough End Mill	Jacob Ackroyd and Sons	—	33	—	—	—	—	—	—	—	—	
156. Ditto	Sutcliffe and Crabtree	—	—	—	—	—	—	40	—	—	—	
157. Ditto	James Mercer	—	—	—	40	—	—	—	—	—	—	
158. Hough End Tannery	George Haste	—	—	—	30	—	—	—	—	—	—	
159. Beeston Road Tannery	Smith, Beacock, and Tanet	—	—	—	—	—	600	—	—	—	—	
160. Marshall Street	Marshall and Company	—	—	—	—	2,700	—	—	—	—	—	
161. Midland Junction	Taylor, Wadsworth and Co.	—	—	—	—	—	150	—	—	—	—	
162. Holbeck Mills	Pearson and Sons	150	—	—	—	—	—	—	—	—	—	
163. Victoria Mill, Holbeck	John Hiscox	100	—	—	—	—	—	—	—	—	—	
164. Low Mills, Low Wortley	Hargreve and Nussy	—	—	400	—	—	—	—	—	—	—	
165. Butter Bowl Mills, North-east of Farnley.	B. Barker and Sons	80	—	—	—	—	—	—	—	—	—	
					—	—	—	—	—	—	—	
166. Far Hough Mill	Clough Brothers	—	—	—	—	—	—	—	4	—	—	
167. Upper Mill	Jno. Ingham and Sons	—	30	—	—	—	—	—	—	—	—	
168. Union Bridge Mill	Benjamin Crowther and Son	—	—	60	—	—	—	—	—	—	—	
		410	475	558	70	2,950	763	180	17	—	85	

Total number of hands, 5,508

RETURN put in by A. M. FOWLER, Esq., C.E., Borough Surveyor (referred to supra, Qu. 6213).

BENYON BECK.

Name of Works or Street.	Name of Occupier.	Cloth Manufacturers and Dressers.	Flax Spinners.	Iron Workers.	Saw Mills.	Remarks.
169. Globe Works, Water Lane	Joseph Green	—	—	30	—	
170. Great Wilson Street	Ellis and Lumb	90	—	—	—	
171. Great Wilson Sereet	W. B. Kirk	—	—	100	—	
172. Old Victoria Foundry, Great Wilson Street	Ellison Brothers	—	—	20	—	
173. Victoria Road	John Atkinson	—	—	—	80	
174. Victoria Screw Works	George Wilson	—	—	26	—	
175. Benyon Mills	Joseph Hodgson	70	—	—	—	
176. Victoria Road	Burnley and Nicholls	—	—	100	—	
177. Siddel Street	Messrs. Green	—	300	—	—	
		160	300	276	80	
	Total number of hands	816				

BALM BECK.

Name of Works or Street.	Name of Occupier.	Chemical Works.	Tanners and Curriers.	Flax Spinners.	Iron Workers.	Remarks.
178. Vulcan Foundry, Low Road	Jubb, Dawson, Wood	—	—	—	12	
179. Low Road Chemical Works	John Jubb	2	—	—	—	
180. Ditto	Usholsenthome	—	—	—	12	1 privy for 12 men; 8 cwt. of lime used per month.
181. Ditto	Atha, Brothers	—	20	—	—	
182. Waterloo Iron Works	R. U. and T. Garside	—	—	—	90	
183. Hunslet Flax Mill	Messrs. Briggs	—	—	1,000	—	
184. Hunslet Carr, near Seven Arch Bridge	Messrs. Gothard	—	—	—	9	
185. Hunslet Carr	Samuel Warburton and Sons	14	—	—	—	1 privy into beck.
186. Carr Moor Side Works	Messrs Tunstall	4	—	—	—	
187. Carr Moor Side Works	Richard Kilburn	—	—	—	30	
		20	20	1,000	153	
	Total number of hands	1,193				

RETURN put in by A. M. FOWLER, Esq., C.E., Borough Surveyor (referred to supra, Qu. 6213).

DOW BECK.

Name of Works or Street.	Name of Occupier.	Flax Spinners.	Iron Workers.	Ware Grinders.	Glue Works.	Remarks.
188. Hunslet Road	Joshua Bower, junior	—	—	—	60	
189. Goodman Street	Hill Brothers	—	37	—	—	Refuse on to their own land.
190. Ditto	Tannet and Walkers	—	500	—	—	Privies used by men empty into beck.
191. Atkinson Street	W. B. Holdsworth & Co.	700	—	—	—	
192. Goodman Street	Messrs. Bucktrout	—	—	27	—	
193. Albert Works, Donnisthorpe Street.	T. Jennings	—	12	—	—	
194. Pym Street, Hunslet Road	G. E. Donnisthorpe and Co.	400	—	—	—	Privies into sewer.
195. Donnisthorpe Street	J. Rhodes and Co.	—	25	—	—	
196. 61 Hunslet Road	Robert Wood and Sons	—	120	—	—	Privies into sewer.
197. Airedale Foundry	Messrs. Kitson	—	800	—	—	14 closets into beck.
198. Old Railway Foundry, Hunslet Lane.	J. Routh	—	129	—	—	
199. Steam Plough Works, Hunslet Lane.	John Fowler and Co.	—	800	—	—	
200. Hunslet Lane Goods Station.	Midland Railway Company.	—	300	—	—	
201. Leeds Iron Works	Cooper and Co.	—	600	—	—	1 privy into beck.
202. Potterdale Mills	Elliott	—	100	—	—	
203. Sun Foundry, Dewsbury Road.	Carratt, Marshall, and Co.	—	130	—	—	
204. Dewsbury Road	J. Buckden and Co.	—	350	—	—	Waterclosets into main drain.
		1,100	3,903	27	60	

Total number of hands, 5,090.

RETURN put in by A. M. FOWLER, Esq., C.E., Borough Surveyor (referred to supra, Qu. 6213).

LEEDS AND LIVERPOOL CANAL.

Name of Works or Street.	Name of Occupier.	Cloth Manufacturers.	Woollen Manufacturers.	Iron Workers.	Corn Mills.	Linen Manufacturers.	Remarks.
205. Tower Works, Globe Road	T. R. Harding	—	—	130	—	—	
206. Globe Works ditto	Newton and Company	—	—	290	—	—	
207. Globe Mill	Jeremiah Clough	—	—	—	8	—	
208. Monk Bridge Works	Messrs. Kitson	—	—	700	—	—	
209. North-eastern Railway Company's Engine Works.	North-eastern Railway Company.	—	—	250	—	—	
210. Castleton Mill, Armley Road	Thomas Luty and Co.	—	—	—	—	150	
211. Canal Mills	James Dixon	140	—	—	—	—	
212. Spindle Works, Armley Road	Messrs. Hattersley	—	—	200	—	—	
213. Leeds Wheel and Axle Company, ditto.		—	—	80	—	—	
214. Armley Road	Southwell and Wilcox	—	—	90	—	—	
215. Albion Works, Armley Road	Greenwood and Batley	—	—	700	—	—	
216. Castleton Foundry, ditto	Woodhead and Co.	—	—	50	—	—	
217. Armley Road	Hinchcliffe Brothers	—	100	—	—	—	
		140	100	2,490	8	150	

Total number of hands, 2,888.

SUMMARY.

	Hands.
River Aire	14,598
Sheepscar Beck	5,241
Holbeck	5,508
Benyon Beck	816
Balm Beck	1,193
Dow Beck	5,090
Leeds and Liverpool Canal	2,888
Total	35,142

LEEDS.

Mr. R. Nickols.

7 Nov. 1866.

Mr. Richard Nickols (Leeds) examined.

6261. (*Chairman.*) You are a tanner?—Yes.

6262. Having tanworks in Leeds and in the country?—Yes.

6263. In what part of Leeds are your works situated?—At the West End, a mile from the Midland Railway Station.

6264. Are they near any river?—Yes, they are on the banks of the river Aire.

6265. Do you know what area of ground you cover with your works?—Yes; I have 3 acres and 3 roods in all, but that area is not all covered with buildings, although I occupy it all in connexion with my business.

6266. How many tan-pits have you?—About 320.

6267. What is their capacity?—They each contain about 248 cubic feet. There are some larger than that; some contain 384 cubic feet. Those are the largest.

6268. Can you state how many of the larger ones you have?—Nearly 100.

6269. What are the dimensions of them. 8 feet long by 4 feet wide?—No. The large ones are 8 feet square. 8 by 8 and 6 feet deep.

6270. What is the size of the smaller ones?—They are 5 feet 6 by 7 feet 6, and 6 feet deep.

6271. What number of skins do you pass through those tan-pits in 12 months?—Of all kinds about 12,000 a week. Skins of horned cattle, calfskins, horse hides, cowhides, and sheepskins.

6272. About what weight of bark should you use in tanning that quantity?—I do not use bark at all in my works there. I use gambier and shumach, and other things.

6273. Are the hides dressed at the same place?—No.

6274. The raw hides come there, and are limed and cleansed there?—Yes, and tanned.

6275. What becomes of the refuse hair and the scrapings from the hides before they are put into the pits?—The hair is sold for manufacturing purposes, for the manufacture of carpets, and cheap blankets for workhouses, and the very short hair is sold for manure.

6276. What becomes of the fatty material?—That is sold to the glue boilers.

6277. Is any of that refuse passed into the river?—No.

6278. Have you any idea what number of gallons of water you use per week. Do you get that from the corporation, or from local wells?—I get it from a well on my own premises.

6279. Do you take any from the river?—Only for injection, for the engine, and for condensing purposes.

6280. Have you any idea what volume of water you use per week?—About 120,000 gallons.

6281. Does it go into the river?—Yes, the greatest part.

6282. Do you frequently change the liquid in the tan-pits, or do you ever change it?—Yes. When the tanning power is thoroughly exhausted the liquid is thrown away.

6283. Does it go into the river?—Some part of it, not all.

6284. What becomes of the spent solids?—They are led away for manure.

6285. They do not go into the river?—No.

6286. You have a large tannery in the country?—Yes, at Bramley.

6287. Do you know about what height the tanyard is situate above the adjoining stream in the valley?—I do not know the number of feet, but it is at a considerable elevation from the river.

6288. And there is an area of land intervening between the tanyard and the river?—Yes.

6289. Do you know how many acres there are of your own land?—Of my own land below the tanyard about eight.

6290. What number of tan-pits have you in use at that tannery?—About 320.

6291. Of what dimensions?—The same dimensions as before.

6292. How many of the large ones are there?—About 68.

6293. What volume of water do you use there per week?—Not nearly so much; perhaps about one third. About 40,000 gallons per week.

6294. Where do you obtain it from?—From water which arises in my own land.

6295. You get it from springs. Do you get any from pumps?—None from pumps. It is all water arising in my own land.

6296. Have you that volume to dispose of every week?—Yes.

6297. What number of skins do you deal with there?—About 1,000 a week, but that is very different leather from what is produced at the other yard. It is all sole leather. The whole of it is large heavy hides.

6298. Do you use bark in that tanning?—Yes.

6299. Entirely?—Not entirely, but chiefly.

6300. What do you do with the great bulk of the solid refuse?—We burn most of it.

6301. Under your engine?—Yes.

6302. What do you do with the fluid refuse?—It flows down the field first, and ultimately into the canal.

6303. Have you had any complaints as to fouling the streams with it?—I had sometime ago a letter from the solicitor to the Leeds and Liverpool Canal Company, stating that they had had a complaint, and that they wished it to be remedied. I replied to it four months ago, and I have heard nothing of it since.

6304. Have you attempted to utilize the fluid refuse upon your own land in any way?—Yes.

6305. In what way?—By turning it on to the grass land.

6306. With what effect in the first instance did you do that?—An injurious effect.

6307. Did it kill the grass?—Yes, I had no crop at all at first; I applied, I believe, too much, and it destroyed the roots.

6308. Have you subsequently made any alteration in the mode of application?—No, I have not tried it since, because I have not had land in a proper state to put it on.

6309. Did you not put some of it in a more diluted form upon the land, and get a better crop of hay?—Yes; in some part, where there has been very little of it, the crop has been very much better, but for the most part it was applied too strongly.

6310. Do you think that it is possible to dilute it or to use it so as to make it beneficial?—Yes; if there was a large space of land it would be very beneficial, but I carry away as much refuse as would manure 40 times as much land as I have.

6311. How many acres have you?—About eight.

6312. And you think that you cannot utilize the waste refuse of that tannery upon those eight acres?—Certainly not.

6313. Is pure water necessary for tanning purposes?—Yes.

6314. Then if you were compelled to rely upon river water, could you carry on your process down in the town?—Not so well. If I was thrown upon that resource I should take the town's water.

6315. You would have to purchase the town's water?—Yes.

6316. If you had neither town's water, nor your own water, what would then become of your tannery?—The result would be very injurious; I cannot speak of it from experience because I have not tried it; I can only form an opinion. I think that in summer time when the river is very foul it would be very injurious indeed, there is no doubt about it.

6317. You might in consequence have to remove your works?—Yes.

6318. And to go where you could get pure water?—Just so.

6319. How many gallons per week have you in the country tannery?—About 40,000 in a week.

6320. That is a very small quantity for 8 acres of land?—Perhaps it may be, but there are only about 5 acres out of the 8 on which I could get it on account of the elevation; it is only on one side of the field that it could be got; the other is too high.

6321. Is it too strong for the land?—There is a very great proportion of salt in it; the hides which I cleanse are mostly salted hides, and the hides have to be cleansed from the salt. It would be impracticable for me to grow root crops, or indeed any other crop than oats, because I want them for my own use for my horses.

6322. Have you tried any mode of abstracting that excess of salt? Is there any means of precipitating it or letting it settle out?—I think not, because it is in solution in the water; there is no residue whatever left of the salt; it is all dissolved.

6323. (*Professor Way.*) Do you not think that by management you might reduce the quantity of that particular liquid and reduce its strength, and then be able to deal with it?—I think not.

6324. Not by putting the skins one after another into the same water?—That might be done, but it would be at too great an expense.

6325. That is to say, as long as you have not to keep your refuse out of the river?—Just so.

6326. (*Chairman.*) Would you think it a great hardship if some regulation told you that you should not put it into the river?—If at the same time I was told what I could do with it I should be quite satisfied; that is to say, without any great excess of cost.

6327. (*Professor Way.*) Do not the skins lose?—They lose considerably in salting; they will lose about 20 per cent.

6328. Supposing that you have 100 salted hides, and that they weigh so much, how much will they lose in the soaking to remove the salt; in fact, how much salt is there in them?—I cannot give you any idea because what weight they lose in salt they gain in water in absorption.

6329. (*Chairman.*) In order to get out the brine the hides are saturated with as much water?—Yes, and with more.

6330. (*Professor Way.*) If you put 100 hides into a certain bulk of water, and then examine the water, I suppose that you could tell me?—Of course if the salt could be extracted from the water it would show what amount of salt came out of the hides. I am not aware of any other means of doing it.

6331. In one of these pits how much water do you put?—They will hold about 1,500 gallons. When the hides are in it, it is about half that quantity.

6332. How many hides?—100 or 120.

6333. I suppose that if I ascertained how much salt there was in a given quantity of that water, you could state how much salt had come out of the hides?—Perhaps you could arrive at it in another way. About 4lbs. of salt is required in salting a hide, it becomes wet from the natural moisture of the hide; after the hide has been soaked for a day or two, the salt which was in it is all brine. It does not all come out at once; we give two or three clear waters to get the hides pure of salt.

6334. (*Chairman.*) The water, I suppose, in that state would contain too large a dose of salt for irrigation?—Yes.

6335. (*Professor Way.*) You have about eight hundredweight of salt to dispose of every week?—Yes, that and considerably more.

6336. And even supposing that you diluted it, it would be too much salt to put to eight acres of land? Yes.

6337. The salt becomes the trouble in that case?—Yes.

6338. In the liming process for the removal of the hair, do you allow the lime to subside for any time before the water is run off?—We do not run off any of that water except the waste water which drains from the hides when they are drawn out of it. We add lime to it, and from time to time the pits are emptied of the substance.

6339. The solid matter is dug out?—Yes.

6340. Is more lime added to the liquid, or is the liquid run off?—The liquid is not run off at all.

6341. The solid lime is taken away?—Yes; the farmers around fetch it.

6342. Is that liquid never thrown away at all?—No.

6343. Only that portion which the hides bring out in the act of removing them?—That is all; the hair is taken off and that brings out a considerable quantity of liquor.

6344. How often in a week do you have to fill up with water?—Perhaps about twice; it is only a few inches.

6345. In order to make good what has been brought out?—Yes.

6346. In what way do you use this very large quantity of water, is it the tan-pits which are run out so frequently?—It is used in the tanning pits and in the cleaning of the hides from the salt.

6347. You give us 120,000 gallons per week?—That is at Joppa.

6348. That is 20,000 gallons a day?—Yes.

6349. You say from the tan-pits the water is not thrown away till it is absolutely done with, and that that is not frequently the case?—Just so.

6350. What consumes those 120,000 gallons of water per week?—The washing of sheepskins. We buy about 4000 to 5000 sheepskins a week, and they consume a great deal of water in washing the wool before it is pulled off the skin.

6351. Does any quantity of grease come out of them; are they washed with soap?—No, only with water.

6352. With clean water in fact?—Yes.

6353. Is the water very foul after they have been washed?—Yes, it is too dirty to wash any more in. We have water constantly running into the pit, and the men are washing the skins and it runs in clean at one end and runs out dirty at the other. The skins are washed one at a time.

6354. Therefore you use the water in abundance?—Yes.

6355. Would it be possible to wash those skins one after the other in the same water, changing the water subsequently?—No; you would deteriorate the value of the wool by that process.

6356. It would not be possible to wash the wool as it is washed when it is off the skin?—No.

6357. There is a machine in use for washing wool by which a good deal of wool is washed in the same water?—Yes.

6358. Does that deteriorate the wool?—Not at all; but the question is not only as regards the wool, but the skin. During the summer it is very important to get sheepskins into cool water as soon as possible.

6359. To prevent fermentation?—Yes; if that was not done in a very few hours they would get very hot, and would spoil the wool and the skin.

6360. You think that this large quantity of water for washing sheepskins is a necessity, and cannot be diminished?—I think so.

6361. Is there anything in that water which is worth preserving, or has any attempt been made to preserve it?—I think not.

6362. Has it been used at all for agricultural purposes?—I think not, because all sheepskins are either washed in the river, or near it; in some rivulet, some running water; that is desirable.

6363. I suppose that there would be nothing in it which would be deleterious?—Nothing but what comes off the sheepskin.

6364. Supposing that the sewage of the town were applied to the land, would there be any reason why this water should not be turned into the common sewers, and so kept out of the rivers?—None what-

LEEDS.

Mr. R. Nichols.

7 Nov. 1866.

ever. It would be rather an advantage, because it is so little diluted with anything that it would act as a cleanser of the sewers; it would be almost a stream of pure water.

6365. With regard to the tan-pits themselves, do you think that that water would be objectionable if it was run into the sewers?—Not at all.

6366. Has it any unpleasant smell when it is fresh, except of course the smell of tanning?—That is all; tan liquor is not a disagreeable thing.

6367. (*Mr. Harrison.*) I believe that there are a great number of hides tanned in Leeds and the neighbourhood?—Yes, Leeds is now a very large tanning district.

6368. It is the largest tanning district in England?—Yes.

6369. Can you state the number of hides of different kinds which are brought per annum into this neighbourhood and tanned?—Last February I got statistics for the purpose of laying them before our members with reference to the cattle plague, and we then found, at a meeting of all the principal tanners, that 2,750,000 hides and skins were manufactured in Leeds in a year.

6370. Were those Foreign or English skins?—The bulk of them were foreign, East Indian skins from Calcutta and Bombay and other places.

6371. Those would be bullock hides?—Yes, the hides of the small East Indian cattle.

6372. (*Professor Way.*) Are not all those hides salted?—Yes, highly salted; a good deal of salt is upon them.

6373. (*Mr. Harrison.*) What proportion of English bullock hides and sheepskins were there?—I do not now remember that, but I think that I can give it to you.

6374. Where are the bulk of these tanneries situated?—There are three very close together; there are two near to mine at Joppa, and there is one at Kirkstall, but Buslingthorpe is the chief place for tanning; there are three or four large yards there.

6375. When a system of sewerage is carried out for the whole of Leeds the water from those tanneries will be discharged into the sewer?—Those at Buslingthorpe are situated upon the Sheepscar Beck, that is the only outlet for the sewage.

6376. Did you hear the borough surveyor state that he had received instructions from the corporation to make plans for thoroughly sewering the whole of the southern part?—I was not in the room when that was stated.

6377. If a system of sewerage was carried out, tan refuse could be carried into the sewers?—Yes.

6378. Your experience of the application of sewage to land is such that you think that the addition of tan refuse would rather improve than diminish the value of sewage for application to land?—No doubt, unless it was too much diluted with water, all our refuse water contains a large amount of manure; at the same time there is a very large quantity of water with it.

6379. What is the loss upon your hides in weight as you receive them into the tanyard, and as you send them out?—It depends upon the state in which they are; dry hides will gain very considerably, weighing heavier as leather than in the raw state. We have a great number of them. On the other hand salted hides will lose from 25 to 40 per cent.

6380. It was mentioned just now by the borough surveyor that the manufacturers who pumped water for various purposes from wells in the town had found the quantity of late years diminish; have you experienced any such thing?—No.

6381. Is yours a very deep well?—No, the bore is about 36 to 40 yards, and my supply is as good now as it was 30 years ago.

6382. Do you know the village of Bramley adjoining where you live?—Yes.

6383. What is the condition of Bramley as to health?—It is very indifferent.

6384. What does that arise from?—I think from bad sewerage.

6385. Is it not situated upon the top of the hills?—Yes.

6386. Should there be any great difficulty in clearing away the sewage from a locality like that?—None whatever.

6387. At present is there any system of sewerage carried out at Bramley?—I think not; if any, it is very little, the drainage is mostly into cess-pits and by top-drains.

6388. Is not the death rate at Bramley very large?—Yes, but it ought to be a very healthy place from its situation and dry soil, it is all on stone.

6389. (*Chairman.*) Do you know whether the excess of deaths has been from fever?—Fever and smallpox; smallpox a few years ago was very bad indeed.

6390. What are the natural facilities which you require for tanning operations?—The first thing is a good tanyard, or rather perhaps I should say, first a large capital, and next a good tanyard, and then a good supply of hides and tanning material, and the requisite information for working it.

6391. You could not put tanworks with the same advantage anywhere could you?—Certainly not.

6392. You must be near to proper means of communication?—Yes.

6393. And you must have water?—Yes.

6394. Is it an advantage to have the means of passing away without objection your refuse or effete matter?—It is absolutely necessary to have that convenience, otherwise you would be shut up at once.

6395. As you are aware of the purport of this inquiry, namely, if possible to diminish the pollution of rivers, if restrictions were put upon your carrying on your trade what effect might such restrictions have. If, for instance, you were told that you should under no conditions pollute a stream what should you say to that?—It would entirely close all the tanyards in this district, they would be useless as tanyards.

6396. Then that being so, any restriction must not take that shape?—Certainly not, or otherwise it would ruin the trade at once.

6397. You say that you use a certain volume of water per day?—Yes.

6398. In using that water you pollute it?—Yes.

6399. And the polluted water must pass away from you by some means?—Yes.

6400. You now pass it away, and you choose a site which gives you facilities for passing it away?—Yes.

6401. Will you admit or not that it is in an objectionable state when it is passed away?—It is objectionable for any other purpose of manufacture, or for domestic use, of course.

6402. Have you in your experience any practicable method of diminishing that objection?—No, I have not.

6403. And so far as you see at present, you must have the right secured to you which you now enjoy, if you are to carry on your trade?—Yes; the right of discharging the refuse either into the river or into the common sewer.

6404. And if the sewage is to be utilized, it will be an operation upon a grand scale?—No doubt.

6405. You say that in your manufacturing processes you would pass nothing into the sewers, so far as you know, which would render that sewage unfit for agricultural purposes?—Certainly.

6406. That is to say if the sewage was fit before?—If it was fit before, what I should turn in would add to its value, and not injure it at all.

6407. You are now a ratepayer to the borough of Leeds?—I am.

6408. You are under the municipal government of Leeds?—Yes.

6409. And if it was found necessary to purify this river upon any great scale, then supposing a process was required incurring an extra expenditure on behalf

of the borough you would be called upon to contribute your fair share according to your rateable value?—Yes.

6410. And if it amounted to some moderate sum it might not drive the trade away?—Certainly not.

6411. But if you were to be told that you should not turn out any of your refuse water into the rivers or sewers it would destroy both you and all the other tanners in the district?—Entirely; it would shut up the entire trade; it would throw I do not know how many, but perhaps 20,000 people, out of bread.

6412. Do you know where you would go to carry on your trade under similar restrictions?—Not in the United Kingdom; we should have to go on the continent somewhere.

6413. If restrictions were made of that class and character they would annihilate the trade not only in Leeds, but so far as you know in the entire Kingdom? Yes.

6414. Therefore, if there are to be restrictions upon you they must be more reasonable ones?—Of course, or else we should be ruined.

6415. (*Professor Way.*) I think that you say that you have not made any attempt, or seen any attempt made, to cleanse tan liquid before it is thrown into the river?—No.

6416. Would you be surprised if I told you that for a very moderate cost you could throw down all the matter out of it, and bring pure water from it?—I should not be surprised at the possibility of its being done, but I should be surprised if I could purify the whole of my water product at a small cost.

6417. You think that you could not do it?—I think not.

6418. Is it not a question of detail?—Yes. That is too scientific a matter for me to give an opinion upon.—Supposing that it could be shown that at a moderate cost you could so treat the matter which you now throw into the river as that a great part of the objectionable character of it would be removed, should you think it a hardship to be called upon to do it?—No, certainly not, if it was at a reasonable cost.

6419. If you could not entirely remove objectionable matter, yet if you could reduce it I suppose it would be an advantage to the river?—No doubt.

6420. The chairman asked you whether moderately pure water was not a desideratum in your operations.—I think that my answer to that question was that it was necessary to have pure water.

6421–2. Then any measure which was taken by the manufacturers and the townships of the whole district to render the river Aire for instance less impure than it is now might probably enable you to use that water for your purposes?—No doubt.

6423. And in general you would share in the advantages of the district?—No doubt.

6424. Therefore, if you had contributed your share of the expense of keeping the river clear you would get it back again?—That is true, but in my individual case, as I have said before, I have an ample supply in my own premises apart from the river.

6425. Which you pump?—Which I pump.

6426. At some expense I suppose?—The pumping is a slight expense, it is not a great deal.

6427. (*Mr. Harrison.*) Is that water much softer than the river water?—Yes, very much softer.

6428. (*Professor Way.*) Is there any iron in it?—I believe not.

6429. Do you find sulphate of iron in it?—Yes.

6430. Is that objectionable to you?—Not at all.

6431. Do you know what quantity of lime you use in a year?—No; but I can let you have the particulars.

6432. (*Chairman.*) What number of tanneries are there in Leeds?—I can give you that. I have the statistics in my office. There are, I should think, 20 or 25, but it is a mere guess, I am not quite sure.

6433. What is the number of pits?—It is very large; I could not give you the number of tan-pits because I do not know what other tanneries have.

6434. What do you do with your ashes?—They are led away to make uneven places level.

6435. You do not launch them into the river?—No, none.

6436. Would the Aire and Calder navigation company prevent you from doing so?—I do not know; I have never had occasion to put ashes into the river,

6437. It has never occurred to you that that would be a proper way of getting rid of them?—Certainly not, and I should never think of it.

6438. Do you know Bradford?—Yes.

6439. Do you know Huddersfield?—Yes.

6440. And the manufacturing districts?—Yes.

6441. In what state do you consider that the rivers now are?—Very bad indeed.

6442. Do you think that it is an advantage to the trade of the district that the rivers should go on being made worse, or that, if possible, something should be done to prevent their contamination?—I think that it would be a great improvement if it could be prevented at not too great a cost.

6443. In saying that, you mean practically and in a common sense manner?—Yes.

6444. Entailing something to which persons could bear to be subjected?—Yes, I think that it would be a great advantage.

6445. In your travels through Yorkshire have you ever seen that not only fluids contaminate the rivers, but that solids are thrown in without let or hindrance?—In many places that is so.

6446. Ashes?—I never knew ashes thrown in.

6447. Would you be surprised if I told you that there are manufactories burning several thousand tons of coal per annum which never cart a spadefull of ashes away, but throw them into the stream?—I never heard of it, and could not have believed that it was so.

6448. Is there anything which you would wish to add?—I am not aware that there is. I should be very glad to see some steps taken to purify the rivers, which would not interfere with the interests of the trade.

6449. (*Professor Way.*) You do not think that it would be done voluntarily?—I think not.

6450. It is not likely that the people interested in the matter here would combine together without some external pressure?—I do not think that they would.

The witness withdrew.

The witness subsequently furnished to the Commissioners particulars of materials, &c. used at his two Tanning Establishments, as subjoined:—

BRAMLEY HILL TOP YARD.

Weight of hides	per week	25 tons.
„ leather	„	14 „
„ lime	„	3 „
„ coals	„	16 „
„ tanning materials, consisting of bark, terra japonica and valonia	„	20 „

Volume of water, 40,000 gallons per week.

JOPPA TAN YARD.

Weight of hides in	per week	70 tons.
„ leather out	„	25½ „
„ lime used	„	9½ „
„ coal used	„	42 „
„ tanning material used, consisting of terra japonica, valonia, and shumac (no bark used)	„	20 „

Volume of water used per week, 120,000 gallons.

Joppa, Leeds, 7th Nov. 1866. (Signed) RICHARD NICKOLS.

LEEDS.

Mr. William Pollard (Grange, near Leeds) examined.

Mr. W. Pollard.
7 Nov. 1866.

6451. (*Chairman.*) You are agent to Sir John Henry Lowther?—Yes.

6452. Where do Sir John's estates lie?—At Swillington, six miles from Leeds. They are three or four miles below the outfall of the sewage of Leeds.

6453. Does the river Aire flow through them?—For nearly three miles.

6454. Are Sir John's estates on both banks of the river?—On one side.

6455. On which side of the river?—On the north side.

6456. How long have you known the river?—I have been agent for Sir John for about 20 years; I knew the river before, but I have known the river well for that time.

6457. Do you know Thorpe Hall pastures?—Yes.

6458. Was the river water at any time used upon Sir John's estate for agricultural purposes, as for watering cattle?—The cattle get to the river Aire on the pastures.

6459. Do they now?—In some parts.

6460. And do they drink the water now?—In some parts they do. In some parts they cannot get to it on account of the plantations.

6461. In what state did that river exist when you first knew it?—When I first knew it it was discoloured a good deal, but there was not any particular smell from it 20 years ago.

6462. In what state is it now?—It is now in a most frightful and wretched state.

6463. Is there any smell from it during summer?—There is such a smell from it in summer, in dry weather, that in passing over the bridge I have sometimes had to put my hand to my mouth and to run to get from it.

6464. Is any portion of the estate building land?—No, none of it has been sold as building land.

6465. Are there any manufactures near there upon the river, or in its vicinity?—There is a brewery near and there are large collieries.

6466. Where does the refuse water from the collieries pass?—Into the river.

6467. Down the watercourses?—Yes.

6468. Are there any fish in the river now?—I should think not, I have not seen any lately.

6469. Do you ever remember any fish being there?—Not many; in a fresh there might be a few fish, but there have not been many fish there these 20 years.

6470. Have you heard anyone make complaints of the polluted condition of the river?—I have heard of many complaints from residents in the neighbourhood, but the land is not thickly populated near the river; the houses are chiefly at a distance from the river, but those who reside near the river have found great fault.

6471. They consider the state of the river a nuisance?—A great nuisance.

6472. In your opinion has there been any depreciation of the value of the estate of Sir John, so far as the river passes along it?—Certainly I think that a pure stream would render the property more valuable.

6473. Are any of the lands liable to be flooded?—Yes.

6474. From the water rising over the surface?—Yes; Fleet Mill Dam has been raised, and I think that that has made it worse.

6475. After these floodings is the land affected in any way?—The water stands stagnant, and it injures the grass very much. Some of the land in that district has been worked for coal. In places where the water can get off again I think that flooding is beneficial, if it does not come during the time when the crops are on.

6476. Have you had any experience of utilization of sewage?—Not further than upon my own farm. The drainage of the township where I live is turned on to a grass field.

6477. Is it ordinary grass?—Yes, pasture.

6478. What is the area?—It is only a small field that it is turned into, about five or six acres.

6479. How long have you put on the sewage?—It has been on during the time that I have occupied that field, probably 15 years, and it was on before.

6480. Is it beneficial or otherwise?—I think that it is beneficial, but it is merely the ordinary drainage of the town, there is no manufacture.

6481. Do you know the river above your estates?—Yes, coming towards Leeds.

6482. In what condition do you find it as it comes towards Leeds?—I am agent for the Speaker of the House of Commons; he has a frontage of about a mile to the river higher up, and when we get above the outlet the stench is not so bad as it is below.

6483. Is the Speaker's land above the outlet?—Yes.

6484. Do you think that if the sewage of Leeds were to be utilized, you would have less nuisance down below in Sir John's estate?—Of course I do, and I attribute the nuisance in a very great measure to the sewage; and as it is intended very much to add to the drainage district of Leeds, of course the nuisance will very much increase.

6485. You think that if they carry out systematically the whole drainage and sewerage of Leeds, the pollution in the river will be very much larger than it is now?—It will become almost insufferable, I do not know how it will be borne.

6486. (*Mr. Harrison.*) Supposing that the corporation wished to apply the sewage to land, is there any land in the neighbourhood suitable for its application, and which could be obtained by the corporation for the purpose?—I think that there would be great difficulty in obtaining it, and I may give this as one reason: Mr. Ingram, in whose land the outlet is, had I believe power to take the sewage water, or the corporation were to pay him 300*l.* a year, and he prefers to take the 300*l.* a year.

6487. Is there much meadow land adjoining the river belonging to Sir John Lowther to which the sewage could be applied?—There is a great deal of good feeding land, but the sewage of Leeds is so much diluted, and there is so much chemical matter in it, that I think it might not be beneficial to the grasses, and it might end in destroying them. The sewage of a manufacturing town like Leeds is a very different thing from that of Edinburgh, where you have chiefly nightsoil.

6488. What chemical works are there in Leeds which would throw in objectionable refuse?—There are several chemical works in Leeds. Hirst and Brooke's is one.

6489. What do they manufacture?—I do not exactly know. There is Armitage's as well. I do not exactly know what they manufacture. I know that they do great injury to the land in the neighbourhood, and have destroyed the grass by allowing chemicals to escape.

6490. You mean exhalations into the air?—Yes.

6491. There have been preventive measures to put a stop to that?—There are large chimneys, but still the chemicals fall down.

6492. Supposing that the sewage was good for the land, and that Sir John had land which was suitable for its application, would he offer any objection to granting the land to the corporation?—I think that he would hesitate about it.

6493. Why?—He lives in the neighbourhood, and I think that it would be a nuisance. There is always a smell from it when you are irrigating land. I do not think that it would answer. I do not think that it would pay.

6494. How far are your meadows from Thorpe Hall meadows, where the cattle plague was?—Probably about two miles.

6495. Did the cattle on your meadows go down and drink the water at the same time that those on the Thorpe Hall meadows which had the cattle plague drank it?—There are several streams independent of the river, and the cattle principally drink there.

There is also a part of the old river which has been cut off, and is left in Sir John's property, and they drink there.

6496. Is there any means of watering cattle in the Thorpe Hall meadows?—Yes, there is the water which runs through the Thorpe Hall meadows.

6497. Is that pure water?—It is tolerably pure.

6498. Cattle were similarly situated during the cattle plague upon the Thorpe Hall meadows, and upon yours as far as the water went?—I think that they had more access to the polluted river than our cattle had. Not many of our cattle could get to the river.

6499. By whom was the mill dam which you mentioned just now raised?—I do not know.

6500. When was it done?—It has been done, I should think, about 20 years. It belongs to the Aire and Calder Company, I think. It is at the Fleet Mills. It causes the land to be flooded.

6501. Have any steps been taken to remedy the mischief?—I am not aware of any.

6502. You have just submitted to the injury?—Yes.

6503. Have the Aire and Calder Company power to raise or lower the dam at will?—I can scarcely answer that question. I think not.

6504. (*Mr. Harrison.*) You wish to represent that the nuisance is very great to the property of Sir John Lowther?—Yes, below the outlet.

6505. That it is increasingly great, and that if it goes on it will be intolerable?—Yes.

The witness withdrew.

Mr. William Swale (Leeds) examined.

Mr. W. Swale.

6506. (*Chairman.*) You are inspector of nuisances for the borough of Leeds?—I am.

6507. How long have you held that appointment?—I was appointed smoke inspector in 1853, and I continued in that office until 1857, when I was made superintendent inspector of nuisances.

6508. What staff have you at your disposal?—At present we have about 20 policemen for that duty exclusively. When I say exclusively, I mean that they are charged with the inspection of nuisances, and the reporting of them. There are also a superintendent of the scavengers, of the street sweepers especially, and a meat inspector, and a smoke inspector.

6509. As inspector of nuisances, do you inspect common lodging-houses?—No, that is a separate department under the police; or rather there is an inspector of lodging houses.

6510. Have you charge of the foul middens and ashpits?—Yes.

6511. And of pigs or pig styes?—Yes.

6512. Are many pigs kept within the borough?—Very many.

6513. Have you frequently to report them as nuisances?—Yes, they are very often complained of by individual inhabitants, and by myself also.

6514. Have you any idea what number of ashpits and privies there are in the borough?—Yes, I have a statement here which I daresay is pretty nearly correct. (*See Paper A, printed at the foot of the evidence of the witness.*) In the township of Leeds there are 7,112 ashpits, or rather privies. I would not call them ashpits. There are sometimes several privies to a pit. In the borough altogether there are about 12,000. That is entirely exclusive of watercloset.

6515. Do you know how many houses there are in the borough of Leeds?—I have not exactly the number of houses now. There are about 45,000 houses. I have calculated that there are about three and a half houses to a privy in the township, and in the borough about three and three-quarters. That is exclusive of watercloset accommodation.

6516. How frequently do you find it necessary to empty those places in the year?—Of course that varies. It depends a good deal on the size of the pit, and the sort of inhabitants; the sort of property.

6517. Where are they usually situated relative to the houses. Are they behind and crowded in amongst them?—They are very close to them; in many places too close.

6518. Are there in any instances bedrooms placed over these privies?—Yes; the figures which the officer of health gave you this morning I have seen myself. There would be nearly 1,000 privies of that sort immediately under dwellings, but there are many more which are close to houses. There is a row of houses, say a dozen, and at the end there are six privies at the gable end of the last cottage.

6519. How long as a rule will the refuse remain in those privies; will it remain six or 12 months?—It has frequently done so.

6520. I presume that fermentation is set up long before that time, and that the matter is putrid?—Yes.

6521. And giving off noxious gases?—Yes.

6522. Do the poor people ever complain to you about the stench?—Very often.

6523. Do the parish officers ever complain to you of it?—The Corporation have a weekly return of the deaths, and we have branch inspectors of nuisances who report to us as to any special cases of disease.

6524. In your inspections do you ever meet with or know the parish relieving officers?—I know them well, and often communicate with them.

6525. Do you ever see them giving relief in those places where these nuisances exist?—They do not give it at those places. I frequently see them visiting there, but relief is given at the office. Of course the township of Leeds has its own parish officers, and the respective townships have their own.

6526. Are those ashpits and privies cleansed by your men, or do you call upon the parties themselves to have them cleansed?—Within the drainage district, which is the most populous port of Leeds, we cleanse the ashpits.

6527. How many do you cleanse per annum on an average?—I have not taken an account of the number. Perhaps scores will be cleansed every week, and hundreds will not be cleansed once in six months.

6528. At what hour in the 24 do you cleanse them?—Mostly from 10 in the night till 7 in the morning.

6529. What is the state of the place at those hours when they are taking this stuff upon the surface?—The state of Leeds from 10 at night till about 4 in the morning is something fearful. I speak from personal experience; the stench is fearful. It is very much better now than it was a few years ago, when I had more especially to deal with it.

6530. Where is that refuse taken when it is carted away?—It is sent off from Leeds as well as it can be by either the North-eastern railway, or boats down the river Aire.

6531. Have you a depôt at any point where you cart it to?—We have not now.

6532. Has any of it at any time passed into any of the streams or becks?—None of the solid matter has been thrown in there by the corporation.

6533. Have you any reason to believe that any other parties pass any of it in, in order to get rid of it?—The contents of the privies of manufactories upon the streams and the river drop into the river.

6534. Are there many cases where the solid matter falls down direct into the river?—Yes.

6535. And floats away?—Yes; during the past three years the corporation undertook the cleansing of these places within the drainage district, and taking the whole three years there were about 55,000 tons a year removed.

6536. From where?—From the ashpits of Leeds, Hunslet, and Holbeck.

6537. At what cost would that be?—About 2,200*l.* a year. That is the dead cost, namely, the loss to the corporation.

LEEDS.

Mr. W. Swale.

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6538. Do you know what the gross cost was?—I have not the figures by me now, and it would be difficult to get at it, because the corporation upon first undertaking it also undertook the railway or boat carriage of the material, so that the gross amount of money was considerable. The Chairman reminds me that it was from 6,000*l.* to 7,000*l.* a year, which left the dead loss 2,200*l.* But I may state that that was from 1860 to 1863, and that since that time the cost has almost doubled.

6539. Do you ever notice any carcases floating in the becks and mill goits and streams?—Very often at certain seasons. Of course after a flood like this we shall not have so many.

6540. Have you instructions from the committee to cause those carcases to be taken away and buried?—We have.

6541. Do you do so?—We have done so.

6542. Is anything of that sort done for the Aire itself?—Yes, as well as the becks. In one day the scavenger removed 50 bodies out of the Aire itself, consisting of cats, dogs, and pigs.

6543. Was that the accumulation of a long time?—No, it was not the accumulation of many days.

6544. You do not imagine that if the river was properly attended to you would have anything like that proportion to take out?—I should think that you might if you set yourself to it take out 50 bodies every day in the year; an enormous number of dead bodies are brought down by the becks, and there are large accumulations at times in the river Aire itself from Leeds Bridge to the Leeds and Liverpool Canal, which is a part which the Aire and Calder Company do not cleanse, nor is it often dredged.

6545. Do you know about what number of water-closets there are in use in Leeds?—There are now about 3,500 receiving water from the waterworks, but that does not include a number used at the large firms and mills.

6546. Then perhaps there would be 1,000 more?—I should think so at least.

6547. That would make about 4,500 as a whole?—There would be more than that in the whole.

6548. 5,000?—Yes.

6549. Are they being added to, to your knowledge?—The watercloset system has now received a considerable impetus. Our officer of health thinks them far preferable to privies.

6550. Have you at any time taken up waterclosets and turned them back again into privies?—I have seen it done.

6551. For what reason?—Because of the water-closets being out of order.

6552. And they have been taken away, and privies have been reverted to?—Yes.

6553. Have you ever to complain of the gasworks; the accumulations of spent lime?—Yes.

6554. How many tons do you think are occasionally accumulated in the yards?—I should think that I have seen 1,000 tons in both the gasworks.

6555. At that time what is the state of atmosphere about those yards?—The cottagers around say that it chokes them.

6556. It stifles them?—Yes.

6557. What becomes of that lime when it is removed?—The farmers take it away and mix it with other tillage for land.

6558. At what time of the year will that refuse accumulate most?—It will accumulate most from now until next spring.

6559. When the farmers are busy in their agricultural operations they will not take it away?—No, nor when they have time; they have not much faith in it.

6560. Have you any authority to compel the gas companies to take it away as it is made, day by day, or week by week?—We have generally found them ready to listen to any suggestions. When the complaints were loudest the committee took the matter up, and I went and saw them, and a considerable outlay was incurred by the new gas company to make sheds, and to build large air-shafts, 30 yards high, for the purpose of preventing its being such a nuisance to the neighbourhood.

6561. Do you think that there would be any great hardship in compelling them to take away that gas refuse week by week?—None at all.

6562. It must ultimately go away?—Yes, and I think that the same thing should be done by the scavengers; the refuse must be taken away sooner or later, the sooner the better for health.

6563. What sort of health have the men who carry out this scavenging?—I have been many years amongst them, and considering the nature of their occupation, and the class of men (they are generally dissipated men). I have been struck with their invariably good health.

6564. They are fond of beer?—Yes, they drink a good deal of beer. The greatest evil which I see among the nightmen is that people encourage their drinking by sympathising with them for the sort of job they have to do, and give them drink too often and too much.

6565. What trade and manufactures in Leeds send out most pollution into the streams?—I have taken a list of them. (*See Paper B, printed at the foot of the evidence of the witness.*) I should think that I know the borough about as well as anyone. I went through the streams and the river, and I have the manufactories and works which are immediately on them. There are three brick and tile manufactories.

6566. What do they pollute the streams with?—I do not think that there is any pollution from them, nor from the bobbin turners, of whom there are two; nor from the corn grinders, of whom there are 15. There are ten chemical works.

6567. What do the chemical works pass out?—They pass out very offensive stuff at times; it of course depends upon the nature of the occupation.

6568. Do you know what chemicals are manufactured?—There are two places, of one of which especially we have great complaints.

6569. Do they make sulphuric acid?—Very few on the stream make sulphuric acid; there are some certainly; but those of whom there are complaints take the spent stuff from gasworks to extract naphtha.

6570. Do they turn anything into the river?—Yes, into the becks and the river.

6571. They turn spent material in?—Yes.

6572. Will you go on with your list?—There are 23 dyers.

6573. The dyers turn in their refuse dye water?—Yes; perhaps there are exceptions to that rule. Some of them turn it into the sewer, but even so it eventually goes into the river. Then there are six iron forges.

6574. What refuse comes from them?—Nothing objectionable excepting from the privies of the men; in most places the soil drops into the water. For instance, Kitson's is a very considerable place, and they turn all their closets into the beck or sewer.

6575. What else have you in your list?—I have 15 flax mills; the water is taken out, and after the flax has been boiled up is turned out again into the river; some of it is worse than the rest.

6576. (*Mr. Harrison.*) Do flax boilers use any acids?—Not that I am aware of.

6577. (*Chairman.*) What is the next item on your list?—There is one felt mill.

6578. Is there any refuse either solid or liquid from the felt mill?—Yes, there is a good deal of washing from it; there is only one felt mill on the banks of the Aire. Then there are three grease extractors. The works of the grease extractors are not very extensive, but they send out most offensive stuff, it is at times very sickening, and as the works happen to be placed upon a sort of goit where the bed is for a time exposed, I have had to interfere once or twice. There is one hair washing and mixing place; that is the hair taken from these tanneries, which will sometimes smell. There is one establishment of leather works, and four iron and coal mines; there are many branches of them; they pump the water.

6579. And the refuse water goes into the stream?—Yes. There are 20 machine makers.

6580. Will anything go from the machine makers otherwise than the refuse of the men?—No. There are three paper mills, and a good deal of refuse goes into the stream from them. There are two oil mills.

6581. What refuse goes from the oil mills?—Very little indeed, nothing offensive; there are 12 tanneries on the streams and the river.

6582. I assume that the spent matter from the tanneries goes in?—Yes; in one or two instances, where they use large quantities of human excrement, the neighbourhood has been very offensive.

6583. Do they use it for tanning?—Yes.

6584. For steeping the skins in?—I can hardly tell in what manner they use it; I know that they have used large quantities of it.

6585. (*Professor Way.*) It is not for ordinary leather is it?—No.

6586. It is Russian leather and those things?—Yes; there is one tobacco mill; there are 49 woollen and cloth finishers, but in that number there are some who are also dyers.

6587. (*Chairman.*) And their wash water and other refuse water goes in?—Yes; so far as I have been able to judge, the water is very much fouled, and I question whether it is not as much fouled before it gets within the borough, as it is within the borough itself. The becks are very much fouled. There are five or six ware and store grinders, two saw mills, and the railway stations.

6588. At the railway station do the waterclosets and the urinals contaminate the stream?—Yes, in some cases.

6589. Have you any further written information?—Something was said about the street scrapings, and the way in which the streets are swept. I must say that I think that there is a very great deal of pains taken to prevent all solid matter getting into our sewers within the drainage district, more pains than usual; about 9,000 tons of the street scrapings are annually sold.

6590. For what purpose can you sell them?—For tillage on grass land, but that is only a very small amount of what is gathered up; many hundreds of tons are gathered up to be disposed of as rubbish, also many thousand tons are gathered up in a semi-liquid state.

6591. (*Mr. Harrison.*) How much do you get per ton for the scrapings?—From 1*s.* to 1*s.* 6*d.*; about 1*s.* 6*d.* delivered at our depôt. The farmers will give about that for ordinary stuff when it is dry, but as it is gathered up from the streets in wet seasons of course there is a very great quantity; I am now speaking of Leeds, Hunslet, and Holbeck. In Hunslet the streets have recently been swept by the Town Council; the streets of Leeds were never in a much better condition as a whole; many of them have been paved within the last few years, but with very few exceptions the whole of the streets are now well paved and drained.

6592. (*Chairman.*) Do you really think that that is so?—Yes; I do not say that there are none unpaved, but there is a very marked difference in the last 20 years.

6593. I suppose that there is a good deal of paving and sewering going on now?—Yes, and there has been for some six years past. In the out-townships, such as Wortley and Hunslet, there are a great many unpaved streets, but I am now speaking of the township.

6594. (*Professor Way.*) What is the nature of the chemical works?—They vary a good deal.

6595. Do you know what are generally the things which they make?—I cannot speak to that; they make sulphuric acid a good deal.

6596. Do they make aniline dyes?—Yes.

6597. How many manufactories of aniline dyes are there?—I cannot say how many, but I know that there are several.

6598. Do they use arsenic?—I am not aware.

6599. I suppose that there are naphtha distilleries?—Yes.

6600. Do you think that you could add to that part of your list the information giving the chemicals which they make?—I could with a little care, but I have wished not to inquire too strictly into them.

6601. Is there much refuse arising out of any of these chemical works?—There is not much solid refuse which goes into the streams.

6602. But is there much liquid refuse?—A good deal of refuse is left to be disposed of; for instance, where Prussiate acid is made.

6603. You mean Prussian blue I suppose?—Yes, they call them Prussiate works.

6604. Prussiate potash works?—Yes.

6605. A good deal of Prussiate potash is used by the dyers?—I believe so.

6606. And these works supply the particular manufacturers who require chemicals?—Yes; there are two of those works which seem to be exclusively employed in distilling naphtha and creosote, and I have had most complaints of those as to their injuring the stream.

6607. Without giving names will you give us information of what these chemical works are?—I will do so. (*See Paper C, printed at the foot of the evidence of the witness.*)

6608. There are 49 woollen and cloth finishers?—Yes.

6609. Does that occupation cause the throwing of any refuse into the river?—A good deal of offensive matter is thrown off by some of them.

6610. Is that as it leaves the dyeworks?—Yes, with many of them.

6611. And they use a large quantity of water?—Yes.

6612. Do you know what quantity of town water is supplied to them?—No.

6613. From the one establishment for hair washing and mixing, is refuse turned into the beck?—Yes.

6614. That is lime refuse?—Yes. They use the beck for washing, and also a bye-wash.

6615. Does that refuse make the water very turbid?—Very much so.

6616. What are the processes through which flax goes here, is it boiled in alkali?—No. Some Chinese grass I think may be.

6617. That you have not mentioned in your list?—No.

6618. Is there much refuse from the flax mills?—No, not much.

6619. The larger portion of the waste matter of the flax is already removed?—It is.

6620. Are the paper mills on a large scale?—Yes, they are rather large, and at times send out very offensive matter.

6621. Do they use anything but rags?—No.

6622. Do they use Spanish straw?—No. I have seen cotton waste.

6623. Is the refuse from those mills a discoloured liquid?—Yes.

6624. Is there much of the fibre itself going down?—Not much.

6625. Have any complaints been made to you of those paper mills?—I have never heard any complaints of nuisance.

6626. There are no fish to kill?—Not now in many of these streams, though I have seen them in all.

6627. Do you know what the paper makers do with the lime which they use?—No.

6628. Is it carted away?—I believe that it is, as rubbish.

6629. It is not thrown into the river?—It is not thrown into the river. Taking the whole borough of Leeds, there is very little solid matter or rubbish to my knowledge thrown in. I scarcely know of a single case.

6630. How are these paper mills situated?—They are on the banks of the Aire.

6631. What water do they use for washing the pulp?—They have wells in all cases.

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6632. Deep wells?—Yes.

6633. And then they discharge into the becks and the river?—Yes. They take water for engine purposes out of the streams as well.

6634. Do you know what quantity of paper a week is made?—I do not. In all cases I have simply taken those works which are on the streams. I have not taken the whole of any particular business but simply those which are directly using the streams.

6635. The other manufacturers must discharge somewhere, I suppose?—They discharge into the sewers.

6636. I suppose that by comparing this list with Mr. Fowler's list we shall see what works are near the river?—Yes, we shall see what are not on the streams.

6637. (*Mr. Harrison.*) How long have you known the river?—I was born very near the edge of the river Aire.

6638. What was the condition of the Aire and the becks leading into it when you were a boy?—I went to fish very near Messrs. Tatham's mill, and my companion was drowned. I never went afterwards, but I had caught many a basketful of fish up to that time.

6639. What fish were they?—They were small fish.

6640. In what year would that be?—In 1826 or 1827.

6641. Do you remember the condition of the river in 1837, when the water company obtained their first Act to get a supply from the Wharfe?—Yes.

6642. What was the condition of the river then?—It was very foul then.

6643. What was its condition when you were a boy?—I have seen it clear for two or three feet deep.

6644. As a source of water supply how was it?—Until this inquiry was instituted I never thought that in my time there had been much water, if any, for domestic purposes taken from the old waterworks. I have many times seen them at work, but that water was confined to a very small portion of Leeds, and I should very much doubt whether it was even then used for drinking purposes.

6645. The inhabitants obtained their water chiefly from wells?—Yes, and springs.

6646. You say that the expense of cleaning out the ashpits has increased lately?—It has.

6647. From what has that arisen?—Perhaps from a variety of causes. The corporation did it in the cheapest way, and in my opinion the most efficient, when it cost the least. It has been since let by contract, and it is now let at about 3,800*l.* a year. The corporation pay that amount for the contractors doing it, and there are other expenses which will make the amount not far short of 4,000*l.* a year.

6648. The present cost to the corporation is 4,000*l.* a year instead of 2,200*l.*, which you mentioned as the former expense?—Yes.

6649. Do you know any considerable area of Leeds where waterclosets have been introduced?—There are very few waterclosets on the south side of Leeds; they are principally on the north side and in the better class of houses. There are few, if any, waterclosets in working men's houses. I scarcely know any, perhaps not more than 100 altogether, in that description of houses.

6650. Are those scattered about the town?—Yes, about the borough.

6651. Have you observed whether the people whose ashpits are close to the house, and sometimes under the house, are at the same time recipients of parish relief to any extent?—They are invariably such recipients, and some are, I had almost said, worse—they are vagrants, they are of the very worst class. I scarcely know an exception.

6652. So that the town is actually paying for the continuance of that system?—Indirectly, no doubt.

6653. Is there any other point to which you wish to speak?—This is the death rate of Leeds (*delivering in the same*).

6654. This is for the year ending December 1861?—Yes.

6655. Is a similar return made out annually?—No. I took it after the census was taken for 1861, and I got it accurately for each district.

6656. (*Professor Way.*) Have you ever attempted to ascertain whether the pollution of the river arising by manufactories, or the pollution arising by sewage, caused you the greatest amount of trouble?—I would put the ashpits first, the pigs second, and the bad drainage third.

6657. As injuring health in houses?—Yes.

6658. Have you many complaints of injury from the river itself?—No.

6659. May we take it that generally the river is so bad that individual cases are not worth considering?—They are not at all. I have found that all I could do was to scavenge and remove obstructions.

The witness withdrew.

Paper A, put in by Mr. SWALE (referred to *supra*, Question 6514).

Population of the township of Leeds - - -	126,637
„ borough „ - - -	228,187
Number of privies, township of Leeds,	7,113
„ „ „ borough „	12,000
Waterclosets attached to waterworks - -	3,500
„ „ other places, such as factories - -	*No return.*

Dead cats, dogs, pigs, &c., 50 a day taken out at times.

Paper B, put in by Mr. SWALE (referred to *supra*, Question 6565).

The following are the Trades and Manufactories either on the banks of the river Aire or on the tributaries, within the borough of Leeds.

Number.	Manufactory.
3	Brick and tile manufactories.
2	Bobbin turners.
15	Corn Grinders.
*10	Chemical works.
23	Dyers.
6	Iron forges.
15	Flax.
1	Felt.
3	Grease extractors.
1	Hair washing and mixing.
1	Leather.
4	Iron and coal miners.
20	Machine makers.
3	Paper mills.
2	Oil mills.
12	Tanneries.
1	Tobacco mill.
49	Woollen and cloth finishers.
5	Ware and stone grinders.
2	Saw mills.
	Railway stations.

Paper C, put in by Mr. SWALE (referred to *supra*, Question 6607).

The kind of Chemicals manufactured at the 10 different establishments named (*) above.

1. Preparations of indigo, ammonia from sulphate, soap, copperas, and china blue. (Watson's.)
2. Coal tar distillers, and plaster of paris makers.
3. Cudbear, archil, and liquid ammonia. (Wood and Bedford's.)
4. Prussiate of potash. (Foster.)
5. Nitric acid, sulphuric acid, nitrate of iron, archil, indigo, &c. (H. Crowther.)
6. Pharmaceutical preparations, generally archil and indigo. (Hirst.)
7. Refiners of indigo.
8. Prussiate of potash.
9. Vegetable naphtha, pyrolignate of iron, and acetate of lime.
10. Vegetable naphtha.

(Signed) WILLIAM SWALE,
Inspector of Nuisances in and for the Borough of Leeds.

Nov. 6th, 1866.

Mr. Charles Chadwick (Leeds) examined.

6660. (*Chairman.*) You are in the medical profession?—I am.

6661. How long have you been in practice in Leeds and the neighbourhood?—I may say 30 years, within a year, in the town.

6662. Then you have known the river Aire during that time?—Yes.

6663. And the tributaries of the Aire?—Yes, generally. I do not wish to speak very particularly about the tributaries above the town.

6664. In what condition is the Aire now as compared with what it was when you first knew it?—It is very different. I knew it 45 years ago, and then it was very respectable.

6665. You would say that it is now a very foul river?—Yes, it is the foulest which I know. I do not know any river like it.

6666. Have you paid attention to the public health in Leeds and its neighbourhood?—Yes.

6667. Have you studied the mortality returns?—Yes, I am generally acquainted with the result, that we stand badly.

6668. Has it occurred to you to inquire as to the probable causes of the relatively high rate of mortality?—Yes, I have long drawn my conclusions.

6669. What are those conclusions?—That we mainly owe our bad state of health to deficient sanitary arrangements; somewhat perhaps to our trades, but not very materially. I also am inclined to think, although I would not venture to pronounce *ex cathedrâ* upon that, that our mortality, if our birth rate be considered, is not so high as it seems to be. I am told that our officers who return these figures state that our birth rate is very large as compared with other towns, and seeing that the mortality is very large among young children, it must have its influence in giving us a worse character than we deserve.

6670. In your professional capacity have you made yourself acquainted with the districts of Leeds where the poor reside?—Yes, I know them generally as bearing upon the supply to the institutions, particularly to the Fever Hospital, of which I have been medical officer for nearly 30 years.

6671. Did you hear the inspector of nuisances say that you have something like 1,000 bedrooms situated over privies and ashpits?—I know that it is so to a great extent, but I had no conception that it was to that extent, at the same time I have no doubt that he is right.

6672. What are the worst types of disease with which you have to deal in your general hospitals?—Fevers are the worst.

6673. Typhus and typhoid?—Yes.

6674. And smallpox?—We have not much smallpox here, we have had the epidemic which has been over the country, but ordinarily we have not much smallpox here, vaccination is now well looked after.

6675. Does typhus prevail more now than it did 20 years ago?—Are you now speaking of the disease generally, or of typhus as distinguished from typhoid?

6676. I have heard Dr. Lankester say that he does not believe in the distinction, that he thinks that typhus and typhoid may be the types of the same disease?—That they belong to the same class I am thoroughly satisfied; there is no doubt a difference, but I have seen the two diseases originate from the same cause, and run their course distinctly. I have seen the rash of typhoid upon one side of the body and typhus upon the other. I have seen death result through typhus taken from a typhoid patient and *vice versâ*. These are facts which I cannot get over.

6677. I have heard it stated that typhus fever is is almost unknown in France, is that so?—Yes to a great extent, that remark is generally true.

6678. That they have typhoid, but not what you term typhus?—They have not true typhus, and for a long time we had not it; all our diseases of that kind were called typhus, but I think that it was perhaps from people not being quite awake to the distinction. Typhus gradually appeared and now we are having more typhus. I now meet with practitioners, young men of 10 or 12 years standing in their profession, who say, "I never saw a case of typhus till now since I was in Glasgow," or in some school, particularly the Scotch schools.

6679. Do you know whether fever has been more prevalent in the country generally within the last six years, than previously?—I have not traced so far as six years, latterly it has been more prevalent than it was.

6680. It is more intensified and more prevalent than it was 20 years ago?—No. In 20 years we have had two or three epidemics; in that time we had the Irish fever, which was in 1846–47 and in 1848–49. In that Irish fever we had both typhus and typhoid. In the last epidemic we mainly had typhoid, till just at the finish typhus cropped up again, that is very singular.

6681. Do you think from your experience that putrid refuse of cesspools and cesspits has anything to do with intensifying the disease?—Yes, in the general results. If you have an over-crowded dwelling, and it happens to be over one of these privies or ashpits, and there is some cause operating upon that particular ashpit to make it worse, the chances are worse against the inhabitants of that dwelling, both as regards the taking of the disease and the bearing of it.

6682. If you remove the poor creatures soon enough from that influence, and put them into a better atmosphere, they have a chance of recovering?—Yes. I was called in to attend a case of diarrhœa which had been going on for six weeks. I saw the patient for only a week, and a very benevolent lady who was looking after the district in which this patient was, and who knew something about him, asked me as a favour to take him into the infirmary. I said "I do "not know whether we shall do much good for him." She said, "He will be better than where he is." I said, "I agree with you." We took him in, and with very little means we made a recovery, but if he had remained where he was, he would unquestionably have died; he is now materially better, that is to say, this week.

6683. Are there any places in Leeds where the poor use waterclosets?—I do not think that there are.

6684. Have you seen any town where the poor generally use waterclosets?—I cannot say that I have.

6685. Have you seen the new earth closet which is so much talked about?—I have not seen it in use, I have heard of it.

6686. What accommodation have you at your hospitals?—At the hospitals we have waterclosets.

6687. And close stools?—Yes.

6688. Do you use disinfectants for the close stools?—Yes, I believe that proper disinfectants are used, both in the fever hospital and in the general hospital.

6689. Would it be a convenience to you in the hospitals if you could have an apparatus which could be used without creating any nuisance?—Yes.

6690. Then I should recommend you to give the earth closet a trial?—I will certainly mention the subject to our board.

6691 The mortality in Leeds this year I think has been upwards of 30 in the thousand?—I am afraid that it has.

6692. Do you know what it has been in the metropolis?—Not intimately, so as to answer any question upon that point.

6693. You have not inspected what may be termed the "slums" of London?—Not to speak authoritatively regarding them.

6694. You know that the metropolis is very much larger than Leeds?—Certainly.

6695. Do you believe that there is as bad a population in London as in any place which you could name in any part of the world?—Yes.

6696. As degraded?—I should think so.

6697. As drunken?—Yes.

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6698. As crowded?—I should think so.

6699. Do you know the mortality in the city of London?—It is low in the city, it is lower than in Leeds.

6700. Do you occasionally see Dr. Letheby's quarterly reports?—Yes.

6701. The city of London is perhaps as crowded with population as any given area which you can find?—Do you think that those persons really live in it?

6702. They do not perhaps live in it?—Do you include St. Giles's in the city?

6703. Take Whitechapel with all its slaughter-houses; then take Lambeth with all its potteries, and then take the south side of London generally. The great distinguishing difference between London and all other towns in Great Britain is this, the cesspit and the cesspool for the most part have been abolished in London, and there are waterclosets by tens of thousands; those waterclosets pass their contents into the sewers and drains and into the Thames. You know that the Thames is very much larger than your river Aire, and it is said to have been polluted until the Houses of Parliament could only sit with closed windows?—Yes.

6704. Are you aware that during that worst year, namely, 1859, the mortality was very low?—Yes.

6705. Throughout all the year?—Yes.

6706. Low relatively?—Yes.

6707. Low even for London?—Yes.

6708. Therefore, showing that a contaminated river is less injurious as regards health than cesspools and cesspits crowded in among houses?—I have not a doubt about it, but then the stream of the Thames is very different from the stream of this river.

6709. There is no doubt of that. You are also aware that Parliament has compelled the purification of the Thames by an enormous expenditure of money and intercepting sewers?—Yes.

6710. And that the sewage is to be applied to agriculture?—Yes.

6711. And that there are from 200,000,000 to 300,000,000 gallons in the 24 hours which will have so to be disposed of?—Yes.

6712. You are also aware that the refuse water of Leeds is now about 8,000,000 gallons?—Yes.

6713. Have you noticed the condition of the several becks flowing into and through Leeds during the last year or two?—Yes.

6714. In what state have they been?—Very bad.

6715. Would you say that they at all influenced the general health of Leeds?—I think that the beck running through the low part of the town and falling into the river at Crown Point has some influence on the town, but I am not one of those who look at single causes for these things.

6716. I suppose that before deciding you would require to know not only the external conditions but the internal conditions?—Yes, the cubic space in which the people live, and the care which they exercise, and the food upon which they live.

6717. Have you seen a report upon Leeds which was made by a Dr. Hunter some years ago?—Yes.

6718. Do you agree with it?—Yes, in the main.

6719. Are you acquainted with the river Aire at the point where the outfall is?—Yes, I happen to know it well; there is fortunately a very small population at that point, but the stench is something fearful.

6720. In hot weather?—Yes, and even when the fullest stream of water is coming down. Mr. Swale was talking about the bodies of cats, and dogs, and pigs, and all manner of things which are sometimes floating about; it is something astounding. I have been particularly directed to that matter from the existence of a neighbouring farmhouse where I have had professional experience, and where for several years all the ailments of the inmates have been more or less influenced by the presence of that debouchment.

6721. There has been there a low state of health engendered by the foul atmosphere?—Yes, and the ailments have put on a particular type from the depressing result of that state of atmosphere.

6722. Then I suppose you consider that if you had the residences there multiplied by thousands, you might have a very frightful mortality?—I am quite satisfied of it.

6723. (*Mr. Harrison.*) How close to the outfall is that farmhouse?—I should think about 200 yards.

6724. (*Chairman.*) On which side is it, on the north, east, west, or south?—It is on the same side as the mouth of the sewer; I think that it is north of the river.

6725. Then a south or south or a south-west wind would cross the river and blow upon the house?—Yes.

6726. So that it would come to them when the atmosphere was the fullest of vapour?—Yes.

6727. (*Mr. Harrison.*) Is the house situated below the outfall?—Yes.

6728. Have you observed that below the outfall there is a considerable deposit in the bed of the river?—Yes.

6729. Have you observed gases rising occasionally?—Not occasionally, but always.

6730. And bringing to the surface solid fœces and black stuff?—I never saw that.

6731. (*Professor Way.*) Can you trace that state of the river to any distance below the outfall?—You see it very markedly at Swillington; the sewage operates upon the whole river; the river is not broad there, the sewage flows in with a little force, and there is a weir just above the outfall, and the sewage often spreads over the whole of the river; one side is not worse than the other that I am aware of.

6732. Have you seen the use of sewage for agriculture?—No.

6733. As a medical man have you formed any opinion whether irrigation by sewage can be carried out without injury to public health?—Seeing that it is generally used in sparsely populated districts I see no reason why it should not be employed; I should not be afraid of its creating any mischief. You would spread it, and not put it on in any intensity.

6734. You are probably aware that medical evidence was given at Worthing, and at Croydon, to the effect that the application of sewage to land was not injurious to health?—Yes, I saw that.

6735. Is that what you would suppose?—Yes, I should say so.

6736. If some scheme was proposed by which the Leeds sewage could be laid upon land should you say that it would be a desirable thing to do?—I should say that it would be. At Thorpe Arch School I was called in to visit several patients whose disorder was attributed to the spreading of some guano in a field in the neighbourhood; but I would not endorse that statement, but it was very generally believed, and at all events there was a smell.

6737. You can smell a guano ship eight or 10 miles off upon the sea?—Yes. The disorder certainly followed in a very extraordinary apparent sequence upon the application of the guano.

6738. The case is hardly appropriate to that of sewage is it?—No, it is not.

6739. Because in the case of sewage the materials are carried into the soil at once?—Exactly.

6740. You as a medical man here would not object to the application of sewage to land?—I should not be afraid of it, it is the way in which I have looked for the disposal of the sewage.

6741. (*Mr. Harrison.*) A previous witness mentioned that there had been a great influx of Irish within a few years?—We always have a large portion of Irish.

6742. Do you find ill health among them to any greater extent than among the rest of your population?—They supply us with a great number of fever patients at our Fever Hospital.

6743. At Wakefield the witnesses stated that a con-

siderable increase in the death rate which they had there was chiefly attributable to Irish immigration; they said that within a few years a great number of Irish had come in?—I dare not make such a statement. I have certainly found diseases of the febrile class very prevalent among them, and they crowd together much more than the English do. Our authorities are very careful in attending to that matter, and I believe that they are doing everything they can to prevent it, and I look to that quite as much as even to the sewerage. Epidemic prevalence of diseases ought always to be taken into account in these inquiries. Although the conditions may be manifestly the same, nevertheless we have five or ten times as much fever at one period as at another. Not long after the Irish fever we got our sewerage into something like operation, and fortunately for Leeds there was then a long period of comparative immunity after that severe epidemic, although we are never without fever. We found people then who were ready to jump at conclusions, and who congratulated themselves and said, "What a remedy this sewerage has been," But my reply always was "Wait;' and although the cycle of the return of the epidemic was a little longer coming round yet it did come, and when it came it appeared that the sewerage had not done much for us.

6744. (*Chairman.*) The question of sewerage and the question of fever are connected, at least in English towns; sewerage and drainage would seriously affect, or might materially improve, the condition of the dwellings?—Yes.

6745. I suppose that you know Edinburgh and Glasgow?—I do.

6746. Where do the poor reside there; do not they generally reside in the upper part of the house?—Yes.

6747. Any amount of sewering and draining could not alter that state of things?—It could not, and I suppose that the walls are impregnated from top to bottom with refuse.

6748. Therefore, if you are to have any improvement in such places you must do something besides making proper sewers and drains?—No doubt.

6749. Sewers and drains are one means to an end, and only one means?—Yes; the fault which they remedy is but one of the things which occasion these diseases.

6750. After houses have been drained in the higher parts of the town have you ever had complaints in the better class of houses in the upper parts of the town?—Yes.

6751. Have you ever had fever in those houses?—Yes.

6752. Has it ever occurred to you that sewering a town or draining a house, unless proper precautions are taken to prevent gaseous emanations, may be a very great evil?—Of course it might.

6753. The first requisite for sewering and draining is effectual ventilation?—Yes, if possible.

6754. It is perfectly possible, and absolutely necessary?—Just so.

6755. What can be so simple as to do what is done in London, namely, to make a rude opening at the surface of the street from the sewer, out of which the gas will easily find its way?—It can be done certainly.

6756. The power of mischief in gas will be from its intensity?—Yes.

6757. When gas is oxidized to a certain extent or is exposed to the open air it apparently loses its power of mischief?—Yes.

6758. And it has apparently its greatest power of mischief when it is placed in a stagnant condition and becomes quiescent?—Yes.

6759. If you are sewering and draining your first principle should be abundant ventilation?—Yes.

6760. And that ventilation should be as unceasing as time?—Yes.

6761. Gases have the same facility for running up hill as for running down hill?—Just so.

6762. And it is quite possible to sewer a town and to drain a town situated upon high levels (where people think it so exceedingly easy), so to poison the people by foul gases?—I have no doubt that there is a great deal in that.

6763. By making sewers and drains with no external means for ventilation?—Yes.

6764. (*Mr. Harrison.*) Have the privies of Leeds in the lower parts of the town been removed and the sewers been made use of thoroughly?—I should think not.

6765. Until you have done that what good are your sewers doing?—That is what I have always said.

6766. You cannot call it a system of sewerage if you just put some great sewers down the streets and only connect the best houses with them?—Just so.

6767. You get illness from fever in the low parts?—Just so. I suppose that you have heard in other places that that is so.

6768. (*Chairman.*) I will give you a list of the towns where waterclosets are general: Alnwick in Northumberland, Morpeth, Lancaster, Worthing, Croydon, West Ham, Rugby, Carlisle, and many other places. Take Croydon, with its population of 30,000, the death rate has been down as low as 17 in the 1,000, it rises up occasionally to 22. There may be reasons why you should not anticipate in a place like Leeds, with your great manufacturing population, a mortality comparable with that, but I do think that it ought not to be much worse than London, which has a mortality of 22½ or 23 in the thousand?—There is no question that we ought to be better than we are, but I doubt about our being as well as London; our soil is different, which I think has something to do with it.

6769. I am not a medical man, but I have seen disease upon a great scale in many parts of the world, and I have been compelled to come to this conclusion, after all my reading and all my inspections, that it is neither climate, nor soil, nor atmosphere externally, but that it is something within the four walls of the dwelling which creates excessive disease?—Yes, I believe so.

6770. I know that climate lowers the constitution. Take India. I am at this moment a member of the Barrack and Hospital Commission for the British Army, and we have returns from all parts of India, from China, and from other parts of the world where British troops are stationed. You are aware that there have been excessive mortalities. On the West Indian stations regiments have over and over again suffered a mortality of 50 per cent. What is the reason of it? It has always been said to be owing to the climate. When those barracks were originally established they were contracted for, and the individual contracted to find the site and build barracks, and they were put into a swamp where no negro would live, and no native would go; and when our poor fellows have been ordered there the officers have made their wills before starting, and the men have given up in despair. But that is not owing to the climate. Shift those barracks on to an elevation of 50 or 60 feet above that swamp, and give troops proper accommodation, and you can secure to the troops a state of health very little worse than that which they would have at home?—Just so.

6771. The mortality in the British Army in India has been as high as 60 or 70 per 1,000, but we now firmly expect to bring it down to below 20 in the 1,000; and we have between 70,000 and 80,000 British troops in India?—Yes.

6772. The mortality of civilians in India, who have the privilege of taking care of themselves, has not been very much greater than the mortality at home?—Just so.

6773. You know, I suppose, by repute what the mortality was in the British Army in the Crimea in the first winter. In the first winter we lost 70 per cent. in three months. I had the honour of being sent out by Her Majesty's Government in the spring following. I landed at the hospitals, and they were burying 70 or 80 men per day. Simply by ventilating the sewers, and flushing and cleansing them, and ventilating the hospitals, and cleansing, and limewashing

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in three months' time the mortality was reduced to four or five per week. Regiments 1,000 strong in the previous winter had lost 700 men, and it was only a question of a few months as to when the last man would have gone off. At the end of that summer the mortality in the entire British army in the Crimea was lower than it had ever been in the barracks at home, and it continued so down to the end of that year?—That is so.

6774. The French did not follow our example, and whereas we had no case of hospital fever in the last three months they lost 15,000 men by hospital fever alone. They lost 5,000 a month. The mortality in the British army upon the average before the Crimean war had been 17½ per 1,000. Since 1858 the mortality in the British army has from similar causes been reduced to 8½ or 9 per 1,000?—May I ask whether in your idea a greater birth-rate has an effect upon the death-rate.

6475. No doubt the great mortality is below five years of age, and if any set of conditions bring you a heavier birth rate, you may infer that you will have a heavier death rate, but how Leeds would stand in that respect as contrasted with Liverpool, or Glasgow, or Edinburgh, I do not know?—Just so.

6776. (*Professsor Way.*) You speak of illegitimate births, I suppose?—Yes, ill cared for children, as is the case with a great majority of the working classes where the mothers go out to work. I find that our birth rate is much higher than at Liverpool. In Birmingham the birth rate is low, and also in Dublin, and there the death rate is comparatively low.

The witness withdrew.

Mr. Thomas W. George (Leeds) examined.

Mr. T. W. George.

6777. (*Chairman.*) You are an alderman of the borough of Leeds?—I am.

6778. How long have you resided in Leeds?—I have resided here the whole of my life, and I am now over 60 years of age.

6779. What business do you carry on?—I am a stuff dyer.

6780. In what part of Leeds is your establishment situated?—On the Kirkstall Road, close to the river Aire.

6781. What number of hands do you employ?—About 160 when we are busy.

6782. What volume of water do you use per day?—About 270,000 gallons.

6783. Where do you obtain it?—We obtain 150,000 gallons from the river, and about 120,000 gallons from a well of our own from a bore-hole.

6784. For what do you use the river water?—For dyeing and washing.

6785. You, I suppose, use it for dyeing and washing dark colours?—We use it for dyeing either dark or light colours. It is very easy to purify water in a dyeing vessel. The character of the water is not very material if it is of moderate purity.

6786. By what process do you purify it?—A little acid, a little alum, or anything of that kind, brings the earthy matter to the surface when the water is heated, and then we skim it off.

6787. Does it at all affect the water for dyeing?—No, this is done in the dyeing vessels.

6788. What are the wares which you use in dyeing?—We use logwood, peachwood, fustic, and other colouring matters for dyeing wool, with the addition of tanning matters for cotton warps.

6789. About what quantity do you use in your establishment?—About 180 tons in the year.

6790. What do you do with the solid refuse?—It all passes into the river.

6791. The solids as well as the fluids?—Yes.

6792. Have you any steam engine upon the premises?—Yes, of about 60-horse power.

6793. Has it never occurred to you to use the spent woods for the furnace?—That is impossible. The wood which can be used in that way is generally chipped wood. We use rasped wood, and it passes away from the vessels, and we could not recover it except at great expense, and then it would not burn.

6794. What number of dye-vats have you upon your premises?—About 30 altogether.

6795. Of what sizes are they?—They vary from about 60 gallons to, I think, nearly 2,000 gallons.

6796. The volume of water which you have stated comes in daily, also, I suppose, goes out daily?—Yes.

6797. Does it go into the river?—Nearly the whole of it. Some of it goes into the sewer.

6798. What weight of coal do you use in the year?—We use about 20 tons a day upon the average.

6799. What becomes of your ashes?—We cart them away to the neighbourhood.

6800. Is the carting of them away a costly process?—Rather costly.

6801. What does it cost you a load?—We have had it done for 6*d.* a ton when we have paid for it, but we generally do it for ourselves.

6802. What is done with those ashes?—They are used for forming streets, and the railway people use them for ballast.

6803. You do not send any of them into the river? No.

6804. Would you be prevented from doing so?—Yes. The millowners using water power would prevent us.

6805. The whole of your refuse fluid and solid in the shape in which it comes out from the vats passes directly into the river?—Not directly. We have a large wooden trough which takes the refuse from a number of other dyers; but it ultimately goes into the river.

6806. If there was an intercepting sewer brought up to you, of course it would be just as easy to pass it away into a sewer?—Just so. Out of the 270,000 gallons of water which we use, we scarcely use more than 20,000 in dyeing. The other portion is used in washing the wares and acids from the pieces.

6807. Then the thoroughly contaminated and foul water would be about 20,000 gallons?—Yes.

6808. If it was thought necessary to remove it that would be about the daily volume which you ought to get rid of?—Yes, it would be very difficult to remove the dye water from the other water. It would require a separate system of sewerage. The other water is very much discoloured.

6809. Could not you easily arrange to pass the contents of the vats when you empty them into some conduit?—It would cost us a large sum in sewers.

6810. Is dye water in your opinion more injurious than the other water?—No, except when we use prussiate potash or bichromate of potash, which might be injurious.

6811. Injurious for drinking?—Yes.

6812. But not liable to fill up the bed of the river?—No.

6813. It is simply discoloured?—Yes.

6814. Have you thought over this question of river pollution as to what effect might be produced upon your business if restrictive measures were put upon you?—Do you mean as to cost?

6815. Supposing that this view should be taken, that these discoloured and filthy waters should not be passed into the river, have you thought what you could do with them?—I know of no profitable way of disposing of the water which we use.

6816. You have not attempted, or heard of any attempt being made to clarify the waters by discharging the colouring matter and depositing the solids?—I have not.

6817. What number of dye houses are there in Leeds?—I scarcely know that. I think that there are only seven stuff dyers in Leeds.

6818. Is the water better or worse for your trade now than when you first knew the river?—There is no doubt that it is worse. When we first went to our

present premises, I think we were at the top of the stream. Since that time one or two dyers have been established above us, and several mills.

6819. Instead of two or three if you had had two or three dozen, they might very materially foul the water for you?—There is no question of it, if you multiplied the mills to a great number. I think that the tanneries are the greatest nuisance to us. We have two or three tanneries above us. We have three now, I think. Messrs. Nickols turn their water into the wooden trough, which we also use.

6820. Do you think that it is at all advisable for trade purposes that measures should be taken to attempt to purify the rivers, or that for trade purposes, you should let them go on as they are?—I think that it is a matter of relative cost.

6821. And that the balance must be between what the trade can bear, and what shall be practicable?—I think so.

6822. Supposing that all the dyers in England were put under the same conditions, would not you then get an increased price for your goods, supposing that the cost was increased?—We should have foreign dyers to compete with if the cost were greatly enhanced to the English dyers. I do not think that as dyers they would come into serious competition with us, because the carriage is so much in our favour, but if we seriously enhanced the price of our goods it would be an evil.

6823. It must be remembered that there is a foreign rivalry as well as a home rivalry?—Certainly; a great part of our stuff trade is foreign trade.

6824. And any restrictions should not be of such a character as materially to affect your market abroad?—Certainly not.

6825. (*Professor Way.*) You say that it is a question of cost, could you give us any notion what, in a a large house like yours for instance, employing 160 hands, would really make a serious difference in the cost of your production; would 50*l.* or 100*l.* a year be a sum which you would find really to affect the value of your goods?—No, I think not.

6826. Therefore, when you say that the trade could not bear any large cost, I suppose that you are speaking of some considerable sum of money?—Yes, but I have no notion that 100*l.* a year would suffice to clarify the water which we use.

6827. When you speak of anything which would interfere with trade, you are speaking not of a few pounds or of a few tens of pounds, but of a large sum of money?—No doubt.

6828. If in a large manufactory like yours any moderate sum of money, say 100*l.* a year, would clarify the liquid before you threw it into the stream, would that seriously interfere with your trade?—Certainly not.

6829. Mr. Rawlinson asked you whether there was anything injurious to the river in the liquid discharged from the dyeworks, otherwise than as preventing the river being used for domestic supply?—I think not in a sanitary view.

6830. Is there anything in dye waste which would be likely to destroy the value of sewage for agricultural purposes?—I do not think that it would improve it.

6831. Do you use a good deal of iron?—We use some iron.

6832. Do you think that it is so great a quantity as to injure grass if the liquid was poured on with sewage?—I cannot exactly state, but I should think not, the volume of water being so great.

6833. You said that you actually took the colour out of the water before you began?—Yes; we take the impurities out of the water; we use alum as a rule.

6834. And lime, I suppose?—No; alum will do it, not interfering with the dyeing process.

6835. Does that equally apply to the water used in washing?—No.

6836. You do not like the river water for washing?—We use a great deal of it for washing; the well water is too salt, and it neutralizes the acid and alters the colour in all vegetable colours.

6837. Therefore, it would be an advantage to you if the river was in a purer state for washing purposes?—No doubt; the river Aire is very good indeed for that purpose.

6838. Supposing that the water of the river Aire was restored to any moderate degree of purity, might the sum of 100*l.* a year, for instance, which you say would not be a serious matter to you, be probably repaid by the better water?—Yes; we would give 100*l.* a year for pure water.

6839. If every person living on the river did what he could to purify the water, he would get the advantage of it?—The dyers would.

6840. So that it would not be a loss to you?—Not if done for 100*l.* a year.

6841. You spoke of rasped wood, might not that be kept out by a system of filtration under pressure?—The quantity is so small in comparison with the water with which it is mixed, that I can hardly think so.

6842. Did you ever hear of a press called Needham's Press?—No.

6843. Do you imagine that if any press could be found, in the nature of a small machine which was moderately cheap and of ready use, you would have a difficulty in introducing it for such a purpose?—A great part of the rasped wood adheres to the pieces when brought out of the vessel, and that is afterwards washed off, and it would be almost impossible to prevent it.

6844. (*Chairman.*) Paper makers use far more water than you do in dyeing?—They do.

6845. You do not use 1,000 lbs. weight of water for every pound of cloth which you prepare?—No.

6846. (*Mr. Harrison.*) What weight of wool do you dye?—We dye Bradford stuff goods.

6847. What weight of goods a week do you dye?—I can scarcely speak with any degree of accuracy; somewhere between 20,000 lbs. and 30,000 lbs., I should think, per week.

6848. (*Professor Way.*) Is the 20,000 gallons of water which you actually use in the dye vats in a day discharged at tolerably regular intervals through the day?—Yes,

6849. If anything could be done with it, it would be discharged pretty regularly?—Yes.

6850. What will a vat hold?—They vary very much; our smallest dyeing vessels hold, perhaps, 80 or 100 gallons, and some, perhaps, hold 1,500 to 2,000 gallons.

6851. So that if anything could be done with that dye water it would be possible to do it in a small space?—I am not acquainted with any mode of doing it, and therefore I can scarcely answer that question.

6852. 20,000 gallons is not a very large quantity?—It is not.

6853. (*Mr. Harrison.*) Are the remaining 250,000 gallons used simply in washing?—Yes.

6854. The water is passed through the goods?—Yes, machines called dollies are used generally for washing.

6855. Do you use any cleansing material besides?—We sometimes use fuller's earth and ammonia and soap.

6856. And all that refuse goes away, there is nothing worth reclaiming?—No, I think not.

6857. You say that you clarify the water for dyeing; would the same process of clarification clear the dye water itself after you have done with it?—I dare say that it would to a considerable extent, but the mode in which we clarify the water is by adding alum when the water is being heated; in the act of boiling the scum is brought to the surface.

6858. You say that tanneries are a nuisance to you as polluting the water for your dyeing purposes; how is that?—They use a great deal of tanning matter which is thrown into the river; sometimes hairs from the hides are mixedwith the tanning matter, and that is injurious to us.

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6859. Do you get a better effect from the dyewood when rasped than when in chips?—Yes, it is scarcely useable for the goods we dye when chipped. Chipped woods are used principally in the dyeing of cloths, but not in worsted goods to any extent; rasped woods give out their colouring matter more easily.

6860. It is not for the purpose of getting a larger quantity of dye from it?—We do get a larger quantity of dye from it, but it is much more convenient for use.

6861. What is the condition of the river Aire now as compared with what you remember it to have been 60 years ago?—This year it has been very good; we have had a great deal of water in the river, and I have seen fish caught in the river opposite our place.

6862. (*Chairman.*) They have come from the upper stream downwards following the fresh water?—Yes. There are fish now in the river. I have seen seen them caught recently.

6863. (*Professor Way.*) I suppose that the fish which you speak of are not a delicate kind of fish?—Certainly not; they are not a trout or char. No doubt the river is worse than it used to be, there cannot be a question about that.

The witness withdrew.

Adjourned to to-morrow at 10 o'clock.

Leeds, Thursday, 8th November 1866.

PRESENT:

ROBERT RAWLINSON, ESQ., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, ESQ. | Professor JOHN THOMAS WAY.

Mr. ROBERT TENNANT (of Leeds) examined.

Mr. R. Tennant.

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6864. (*Chairman.*) Do you reside near Leeds?—Yes.

6865. Are you engaged in any business in or near Leeds?—Yes; I am a partner in the firm of Messrs. Hives and Atkinson, flax spinners.

6866. Where is the mill situated?—In East Street.

6867. Near any becks or rivers?—It is on the river Aire, at the junction of the Sheepscar beck with that river.

6868. What is the name of the mill?—Bank Mills.

6869. What number of hands do you employ?—They vary from 1,200 to 1,400.

6870. What weight of flax do you treat per annum?—Between 2,000 and 2,500 tons.

6871. Is it grown in England or in Ireland?—It comes principally from Ireland, to some extent from Russia, and to a very small extent it is grown in England.

6872. Do you use water in the processes of manufacture?—We use it for the engines, for condensing and boiler purposes, also for filling the spinning troughs with hot water to macerate the fibre in the process of spinning.

6873. To what condition has the flax been brought then?—It is scutched.

6874. When the flax has been freed from the woody fibre all the steeping and soaking has been done?—Yes.

6875. Flax, as it is produced in a vegetable state, undergoes a process of steeping?—Yes.

6876. In that steeping a considerable amount of water is polluted?—I believe so, but we have nothing to do with that process.

6877. Do you use much water?—From about 1,000 to 1,200 gallons per minute.

6878. Where do you get it from?—From the river.

6879. Do you obtain any from the Corporation Waterworks or elsewhere?—None for the mills; we obtain some for drinking purposes from the waterworks company. In a dry time, when the river is very offensive, which it often is, we use the waterworks water for filling the spinning troughs.

6880. And for steam boiler purposes?—No.

6881. What engine power do you use?—800-horse.

6882. Do you know what weight of coals you consume per annum?—From 10,000 to 11,000 tons.

6883. What weight of ashes does that quantity of coal produce?—I think it costs about 2*l.* a week to lead them away. There are about 24 tons a week—nearly 1,250 tons a year.

6884. About one-fifth of the weight of the coal goes into ashes?—I believe that is about the calculation.

6885. Do you use any water power?—No.

6886. How long have these works been established on the river?—A long time, nearly 50 years.

6887. Is the water better or worse now than it was at first?—It is very much worse.

6888. Is it injuriously worse in the process of manufacture?—Certainly.

6889. Have you at any time since those works have been established passed waste ashes into the river?—I believe never.

6890. Are there any restrictive clauses in the Aire and Calder Acts to prevent your doing it?—The proprietors of the Aire and Calder Navigation are conservators of the river for navigation purposes, and I am certain that they would prevent any deposit of ashes in the rivers if it were attempted.

6891. Do you know the rivers of Yorkshire generally above or below this point?—Yes; I know the neighbourhood of the Aire and the Wharfe well.

6892. Do you know the rivers in the neighbourhood of Huddersfield and Dewsbury and that district?—No; I am not so well acquainted with them.

6893. Do you think that any manufacturer is justified in discharging his ashes into streams?—Certainly not.

6894. You think that in all cases ashes ought to be kept out of streams?—I think so, certainly.

6895. Would you be surprised if I told you that persons burning almost as many coals as you do never cart a load of ashes away, but pass them all into the stream?—I certainly should, for I never heard of it.

6896. If such a thing takes place, I suppose you would say, as a person interested in the district, that it ought to be prevented?—Most certainly.

6897. That other parties should be compelled to do what you do?—Yes.

6898. You say that they should take the ashes away?—Yes. I think we should all be on the same footing.

6899. For what purposes are your ashes used?—Partly for filling up in foundations for buildings, partly for making streets, and for ballasting on the railway, at the nearest point where they can put them, and where they are wanted.

6900. Do you find that removing them costs you more at one time than another?—It is more difficult certainly to do it sometimes than at other times.

6901. And becomes more expensive?—Yes; when we calculated 100*l.* a year, I should say that sometimes we contract for so much a load, and sometimes we use our own horses and carts.

6902. Do you use the town's water by an annual contract, or by meter?—By meter.

6903. How much do you pay per 1,000 gallons?—6*d.*

6904. Have you any idea how much you consume in a year; or the cost of it?—It is very small; about 25*l.* a year.

6905. What form of pollution do you think injures the water the most for your purposes?—Refuse from tan pits, dyeworks, and gasworks.

6906. From the gas companies works that supply Leeds with gas?—Yes.

6907. What refuse do they pass in?—We have had tar floating on the surface, and once the piston-rod of the engine was choked, and the engine had to stop, by reason of the gas tar coming into the river and getting into the rings round the piston-rod and choking it.

6908. The tar had been drawn into the piston by the priming of the boiler with fouled water?—Yes.

6909. Have you complained as to that state of things at any time?—It has not occurred within the last few years with the gasworks.

6910. Are you aware that gas operations may be carried on without passing one ounce of refuse matter into the stream?—Yes, I understand that that may be done.

6911. If that is the case, and it can be done, do you think that there should be some authority to see that it is done?—Decidedly.

6912. Do you think that the gas refuse comes from any small works, or from the town's works?—From the town's works.

6913. (*Mr. Harrison.*) How long ago is it since the choking of the piston rod occurred?—Some five years ago.

6914. (*Chairman.*) How many steam boilers have you on your works?—12.

6915. How often do you cleanse them?—The boilers are cleaned two every fortnight.

6916. What is the length of them?—They are about 32 feet long.

6917. Are they the ordinary circular boilers?—Yes.

6918. What is the character of the refuse you get out of them?—It is principally the caking on the boiler itself.

6919. Is that a material that will not blow out?—Twice every day every boiler is blown out.

6920. To discharge the refuse mud from the bottom?—Yes.

6921. And yet it is necessary to cleanse once a week?—Yes, besides.

6922. That is to say, each boiler will go for 12 weeks without cleansing?—11 weeks.

6923. Is that operation of cleansing carried on more often now than it was some years ago?—I believe it is.

6924. What arrangement have you upon your premises to get rid of the effete matter from the men working there?—It all goes direct into a drain which goes into the river at once.

6925. Have you ever thought of utilizing it in any way?—No, we never did; they are now all water-closets.

6926. Have you seen the earth closets of the Reverend Mr. Moule?—No, I have not.

6927. Are you a magistrate of this county?—No. The day before yesterday we were stopped for 20 minutes from the pipes being choked up with refuse coming down the river; I mean the supply pipes; it costs us now a considerable amount a year to have the river dredged to keep it in such a state that we can use the river water for engine purposes.

6928. Do you dredge past your works?—Yes, a little above. The Aire and Calder proprietors dredge it at our request on our paying for it.

6929. What does it cost per year?—I am not prepared to say.

6930. They dredge at your request, but at your cost.—Yes; they used to dredge at our request without our paying, but now they make us pay.

6931. What kind of material do they usually dredge out there?—I have not noticed it particularly, it is black, dirty-looking stuff.

6932. Do you ever find in your boilers solid sediment from dyewoods and spent bark from tanneries?—There is solid refuse which we get out of the spinning troughs, which goes away every week; we give it away, and it is used as manure.

6933. That comes from your own premises?—Yes; still it is the sediment from the water taken from the river; it comes to a very small extent from our operations.

6934. In the event of any regulation being adopted for purification of rivers, what would your firm say to any restrictive measure being put upon you as to withholding human excrement from the river; would you be prepared to meet the necessary cost of getting rid of the evil?—Yes, certainly. I am supposing it can be done at some reasonable expenditure within our power.

6935. Something practicable and marked by common sense?—Certainly.

6936. Do you think, supposing the most complete arrangements were devised and put in force by yourself, that your example would be sufficient to induce other manufacturers to adopt them?—Certainly not.

6937. Is it necessary that some properly constituted authority should be empowered to insist upon the adoption and continuance of those measures, whatever they might be?—Yes, feasible measures. I think the only means of accomplishing it is, to make it universally compulsory.

6938. Looking at the state of this river now, do you know whether it has become very much worse within the last 20 years or not?—Yes, it has within my own knowledge.

6939. If left alone, looking at the growth of trade, what would you say might be its condition in 20 years hence?—I cannot say that; but if it goes on becoming as bad in the next 20 years as it has in the last 20 years, it will be almost unfit to use.

6940. If that is the state of a river of this volume, it would be worse with a small stream upon which there were more manufactories?—Yes, it is worse now on the Sheepscar beck, four or five times as bad.

6941. As pollutions exist throughout the whole of the drainage areas which are shaded pink on the map, and those pollutions may come down upon Leeds from the very sources of the river, do you think that any authority should be placed in the hands of the Town Council, and should be made co-extensive with the drainage areas?—I think that an independent authority, co-extensive with the drainage areas, would be better than a limited authority which could only be vested in the Town Council, and which could not extend beyond its own borough.

6942. The Town Council might be armed with powers within their own borough, but such powers, you think, would have to be made far more extensive?—They must extend, I think, to the point where the fouling commences. There are many rivers, in fact I know some in Yorkshire, where there are no Town Councils on the banks, but which would also have to be protected; there may be local boards of health in some of the villages, but no general jurisdiction, I think, is exercised by anyone.

6943. Do your workmen complain as to the stench from the river in dry weather?—I have complained myself many times; sometimes it is so positively offensive that sitting in the office is really quite unbearable.

6944. Have you noticed, during the time that the river is so bad, floating carcases of dead animals thrown on the mud banks?—Yes, I have seen them going down the river, and in the small beck. I have seen them in considerable numbers.

6945. Lying there for a considerable time?—I believe they lie there until the next fresh takes them down.

6946. Or until they decompose?—Yes.

6947. Do you think it would be a very easy process immediately to remove all such forms of nuisance?—I believe that means have already been put in force, as to the particular beck I refer to, for narrowing the area of the beck, and letting the water go in a smaller channel, which would have that effect.

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6948. If the floating carcases are not removed and buried, do you think it would effect a cleansing of the beck simply to narrow its channel so that it would float them downwards into the main stream?—No. I think they ought to be taken out and buried when they are seen.

6949. As far as is practicable, I assume that you would prohibit the throwing in of carcases of dead animals?—Yes, I would.

6950. And fine persons who were found doing it?—Yes.

6951. (*Mr. Harrison.*) Did you not say that you use about 1,000 gallons of water per minute?—Yes.

6952. That is 60,000 gallons an hour?—Yes.

6953. Working 10 hours a day?—Yes.

6954. That is 600,000 gallons a day?—Yes.

6955. You say that you pay to the corporation about 25*l.* a year for water?—Yes.

6956. How many thousand gallons would that be at 6*d.* a gallon?—I looked at the last quarter's bill and I saw that it was 250,000 gallons. I think the bill was about 6*l.*

6957. About a million gallons a year?—Yes.

6958. Whereas you use actually about 600,000 gallons per day?—Yes.

6959. You pay to the water company 25*l.* in one year for a little more than one day's consumption?—Yes.

6960. Taking your consumption at 600,000 gallons a day, what would the payment be to the water company per day at 6*d.* a gallon, if you bought the whole of it from them?—15*l.* a day.

6961. You would have to pay that to the water company if you took all from them?—Yes, if it came to that.

6962. You say that the water of the river is so bad that you are obliged to have recourse to the water company for a supply, as the other is not suitable for your purpose?—Yes.

6963. On what occasions has that occurred?—In a very dry time when the river has been very offensive, but then we have only used the town water for filling the spinning-frame troughs, not for condensing or boiler purposes.

6964. Taking those 600,000 gallons of water, what are the different purposes for which it is used?—For condensing and boiler purposes, for the spinning frame troughs, and for the waterclosets.

6965. How much is used for those purposes?—Of the 600,000 gallons used daily, 500,000 go back to the river from the air-pumps, 20,000 are used in the boilers for steam, 5,000 are absorbed by the yarn which is afterwards dried, 1,500 are returned to the river from spinning troughs, 73,500 are used for flushing waterclosets.

6966. Then one half is more or less polluted from the waterclosets or from the machinery?—That is so.

6967. What portion of the 600,000 gallons should you be obliged to have recourse to the water companies for, supposing that the water of the river was so polluted that it was not suitable for your purposes?—It happens so rarely and for so short a time that I cannot say.

6968. How much water do you use daily for the purposes which require pure water?—In ordinary times we use the river water for every purpose, except for drinking. Supposing the river was always so offensive as it is at the particular times when we resort to the waterworks company for water, I am not prepared to say how much per annum we should require.

6969. (*Professor Way.*) If the water were to go on getting more and more impure, as it must do, would there not come a time when you must either buy water at a ruinous cost or give up your business, and then what quantity of water would be absolutely necessary for you?—I am not prepared to say at this moment.

6970. I think you stated that from 2,000 to 2,500 tons of flax were used per annum in your works?—Yes.

6971. And you have stated the quantity of water that is used?—Yes.

6972. I think you will find that the quantity of flax used per day would be seven or eight tons?—Yes.

6973. Then the proportion would be something like 400 tons of water to each ton of flax?—I have not calculated it.

6974. (*Mr. Harrison.*) What is the present cost of pumping water from the river?—I cannot separate it from the general engine expenses.

6975. What height do you pump it?—No great height. The river flows close past the foundations of the mills.

6976. (*Chairman.*) Of what diameter is the pump that lifts the water from the river?—The pumps vary from 2 feet 6 to 16 inches. We have six pumps, and those are the diameters of the pumps.

6977. (*Professor Way.*) What is the object of the hot water that is used for the flax; to soften it?—Yes; in the process of spinning, it is to separate and macerate the fibre.

6978. Does it take out any gummy matter?—Yes, whatever is left in it.

6979. What is the nature of the liquid that comes away from it?—The water itself is not more impure than when it comes in, but there is a residuum which, as I have said, is sold for manure, or it is taken away for that purpose. That residuum comes by subsidence.

6980. Is any of that residuum to be found in the water which has not subsided?—I think that some of it goes back into the river.

6981. If any ready means of filtration not taking up a large space could be found, that might be separated too?—If any means could be devised to do it we should be glad of it.

6982. You mentioned something as to gas tar, and it is desirable that the question should not be misunderstood; was it five years ago that the occurrence you referred to took place?—Yes.

6983. Probably at that time gas tar was not so much in demand as it is now?—I do not know.

6984. You know that the aniline dyes are made from gas tar?—Yes.

6985. So that the gas companies probably do not lie under that stigma now?—I do not know.

6986. Do you anticipate that you shall always be able to dispose of your ashes for building and so on?—So long as the borough continues to extend I suppose we shall. There is increased difficulty occasionally in it, but as a rule we can get them away.

6987. There is no flax, I believe, grown in this neighbourhood?—Not within eight or ten miles.

6988. Did not Mr. Marshall grow a quantity of flax?—Yes.

6989. Was it more for experiment than anything else?—No; it was carried out to a large extent.

6990. Had he not reclaimed a quantity of land for the purpose?—I do not know, but he used to grow it largely.

6991. Where was it retted?—On the spot.

6992. Is there any retted in this district?—Not that I am aware of; I do not ret any.

6993. Supposing that any plan could be suggested to you for absolutely purifying this flax water before it runs into the river, what would you consider a burdensome expense to meet?—I think I may say that we should not feel the loss of such a sum as Mr. Alderman George mentioned yesterday.

6994. Or perhaps twice that amount?—I do not know that.

6995. Would not the sum be inconsiderable compared with the interests concerned in having clean water to use?—Decidedly.

6996. If you were putting up your flax mills now, and the question was whether you should have the water as you have it, or comparatively pure water, it would make an immense difference I presume in your view as to where you should erect the mills?—Certainly, if we had all other things equal, it would make all the difference.

6997. Taking for granted that everybody did the same thing?—Yes.

6998. Should we be justified in inferring that as you use so many thousand gallons of water per day for a purpose for which you require comparatively pure water, and the river is becoming more and more impure year by year, if it is allowed to be polluted at the same rate for some years to come, the water will be quite unfitted for your purpose, and you will be driven to purchase other water at the rate of 6*d.* per 1,000 gallons, and you will be a loser of so much per annum?—No; I am not prepared to say that.

6999. What would be your remedy?—That I am not either prepared to say; no doubt some means might be resorted to that would purify the water sufficiently for that particular purpose without going to the expense of 6*d.* per 1,000 gallons.

The witness withdrew.

Mr. Alderman Robert M. Carter (of Leeds) examined.

7000. (*Chairman.*) How long have you been resident in Leeds?—About 35 years.

7001. You are an alderman and a member of the Town Council of the borough of Leeds?—Yes.

7002. And chairman of the Waterworks Committee?—Yes.

7003. And you have taken a very active interest, I believe, in the municipal government of Leeds?—I have for the last 16 years.

7004. You have been chairman of the Scavenging and Nuisance Committee?—Yes, for six or seven years, I think.

7005. I think you have had something to do with getting the new Improvement Act?—I have.

7006. For the better government of the borough?—Yes.

7007. You have also, I believe, recently obtained an Act to enable you to deal with the becks and to improve their condition?—Yes.

7008. Did you take part in the sanitary works that were carried out some years ago?—Yes, as a member of the Council, and also as a member of the Sewerage Committee. I remember being a member of the Sewerage Committee for one year only, but I have taken part as chairman of the Nuisance Committee, and I have come into contact a good deal with the Streets Committee, as to the sewerage, and I understand pretty well the whole of the system of sewerage.

7009. Is Leeds in a better sanitary condition than it was 10 or 15 years ago?—I do not think the death rate is less, considering what has been done to improve the town, but one would infer that it should be in a better sanitary condition.

7010. You have spent large sums, I believe, on the main sewers?—We have.

7011. Do you know the death rate of other towns with populations approaching to that of Leeds, such as Birmingham, Sheffield, Manchester, and Liverpool?—I know it simply from the registrar's returns. I know that Liverpool is worse a good deal than Leeds, and I know that Birmingham is much better than Leeds.

7012. But you cannot account for it?—No; unless the young people at Birmingham leave Birmingham for other towns. I know that the birth rate at Birmingham is as large as the birth rate at Leeds, but the death rate is immensely below.

7013. Have you ever made a personal inspection of any other borough than your own?—Not such an inspection as would enable me to to give any very reliable opinion. I have visited Sheffield and Manchester and Liverpool, and other places, but only with the view of ascertaining how they dealt with their ashpits and waterclosets.

7014. In Sheffield, I believe, sanitary works have not been carried to anything like the same extent as in Leeds, they have not any system of main sewerage?—I do not know.

7015. Did you hear your inspector of nuisances give his evidence yesterday?—I did.

7016. Did you hear it stated that there were at least 1,000 ashpits and middens placed under sleeping rooms?—Yes.

7017. Do you think that that may account for the increased death rate in Leeds?—Unquestionably; I think that has very much to do with it, because only the very poorest class of the people occupy those places, the class of people that are the least able to resist disease when it comes upon them.

7018. Did you hear also the evidence that was given with regard to the ventilation of the main sewers?—Yes.

7019. Taking Leeds and Liverpool, which are not very dissimilar as to gradients, is it possible that there may be something wrong as to the ventilation of the sewers?—Yes; I have several times pressed the question of the ventilation of the sewers on the Town Council during these last six or eight years, because I have observed that fever was generally the worst in the neighbourhood of places where there was an escape of foul gases from the sewers. I will give you an instance. My attention was called to that matter as chairman of the Nuisance Committee. The gradients of some of the sewers are very steep indeed; the main sewer runs just down by the river for one half of Leeds, and the streets leading to what we call Richmond Hill run along from that main sewer; and fever, I believe, has been prevalent on that hill side for years more than in any other part of the town. I believe it has been in consequence of the sewers not being properly ventilated, especially in that part which may be called the outlet.

7020. Do you know, as chairman of the Nuisance and Sewerage Committee, what is the sectional form of the sewers—oval, or a flat invert?—It is the oval egg-shaped sewer. I believe there is no fault whatever to be found with the sewer itself, with its mode of construction, or anything of that kind. I think if it is defective at all, it is defective in that respect that you pointed out yesterday afternoon in reference to ventilation.

7021. The question of ventilating sewers is one of the most vital questions concerning the health and welfare of the town. In Liverpool, as in Leeds, when you have expended vast sums of money in the hope of improving the sanitary condition of the population, you find that as you spend your money something has increased the rate of mortality. Is not that so?—It appears to be so in Leeds. As far as Leeds is concerned I think we are culpable until we really do attempt to remedy it. It has occurred to me that we could ventilate our sewers as the coal masters ventilate their coal pits—for the coal is so cheap that we might actually draw the foul air out of the sewers.

7022. You have a great outlet sewer leading down to the Aire?—Yes.

7023. Do you know whether the mouth of that sewer is open or not?—It is; it is open I daresay for about a mile.

7024. I mean the end of the sewer where it delivers itself into the open channel; is there any arrangement for a flap valve over the mouth of it?—No, I think not.

7025. If the mouth of that sewer was presented to the current of air now moving the air would blow into the sewer, and force up all the gases into the higher parts of Leeds, and instead of ventilating Leeds by this volume of air particular parts in the upper portion of the system may be poisoned much worse than if you had a stagnant atmosphere?—Yes.

7026. You have a number of cellar dwellings in Leeds?—Yes, a very large number.

7027. Do you know that formerly cellar dwellings abounded in Liverpool?—No.

7028. About 20 years ago a population of 50,000 persons lived in cellar dwellings, the ceilings of which were below the level of the streets; are the cellar

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dwellings in Leeds, many of them, or any of them, below the level of the adjoining street?—Yes; those situated down at the bottom of Kirkgate, in those yards running off from Kirkgate, and on the bank. The cellar dwellings in the out townships of Hunslet and Holbeck are not of that character, but rather of a better character.

7029. Are any of those cellar dwellings liable to be flooded by overflow from becks that you are aware of?—Very few of them.

7030. Have you ever heard of any being liable to be flooded by the sewage back-watering up in time of floods?—No.

7031. Has it been contemplated by the town council to regulate the occupation of the cellar dwellings?—It has.

7032. Do you know that the Liverpool corporation are preparing to expend a large sum of money to remedy the mischief of the last 30 years in the overcrowding of houses?—Yes, I do.

7033. They intend to spend many hundreds of thousands in pulling property down?—Yes.

7034. For the future I suppose you would think that your restrictions ought to be such as to prevent the necessity for similar large expenditure?—Yes.

7035. Have you much difficulty with your ratepayers in carrying out sanitary improvements; is there much opposition to the expenditure of money for those purposes?—No, I do not know that there is; there has been a little stir sometimes got up for political purposes, but in no case a general opposition of ratepayers to improving the sanitary condition of the town.

7036. You think there is so much good sense among the working men of Leeds, if matters are properly explained to them, and they are shown that these works are necessary for their health, that they would be willing to submit to an increase of the rate, if necessary?—When I spoke of any opposition I did not at all refer to the working classes; the opposition has always come from the owners of cottage property, not from the working classes; they invariably support any measures for the improvement of either their streets or dwellings, or anything connected with those things.

7037. Do you know what is considered to be about the rate of interest that an owner of this worst class of property desires to get?—I think they are getting from seven to 12 per cent.

7038. Do you know, from personal inspection, the state of this class of property?—Cottage property has increased very much in value in Leeds in the last five or six years. I am a trustee of one of the largest building societies in England, and therefore know something about the value of cottage property in Leeds; we lend out money to build cottage property, principally, to the amount of something like 8,000*l.* per month. I know that the cottage property in Leeds at present, or the majority of it, pays from seven to 12 per cent. and the worst cottages and the cellar dwellings pay the highest interest of almost any in the whole lot. The best class of cottage property pays the lowest per-centage, and the worst pays the highest.

7039. That being the case, if we pursue that inquiry a little further, it comes to this, that if the bad condition of the property and overcrowding produce disease and fever, and other analogous diseases amongst the working people, it produces to a certain extent pauperism also, and the parish steps in and gives relief?—Yes.

7040. It gives relief either out of doors or by removing the poorer inhabitants into the workhouse?—Yes.

7041. If the father is taken off by typhus fever prematurely, his wife and children may become permanent paupers?—Yes, that is so.

7042. Then, going a little further, is it not almost quite clear that the parish is mulcted, and through the parish the public, for that state of things?—No doubt it is the dearest possible way of conducting the affairs of a town to allow a cause of disease to exist to take off the heads of families, and then to keep the children.

7043. Do you know that typhus fever attacks more fiercely and more fatally persons in the prime of life—between 20 and 40?—I do not know that, but I am not surprised to hear it. I know that parties who from time to time enjoy the fresh air and are obliged to come into conditions of atmosphere which are unvourable, are as liable to take the disease, or more, than those who live regularly in it.

7044. I believe the fact is that where typhus fever attacks an adult in the prime of life he has less chance of recovery than younger or older persons?—It may be so.

7045. To what extent do you, as a corporation, cleanse the ashpits and privies at the public expense? Do you cleanse the whole of the borough, or only a portion of it?—Only a portion of it; only the drainage district of Leeds, Hunslet, and Holbeck.

7046. Do you know what it costs the borough annually to cleanse those ashpits and privies?—The net cost now is about 4,000*l.* per annum.

7047. Is that the net or the gross cost?—The net cost. It is now let to contractors for 3,800*l.*, but in addition to that we have officers to support to look after the contractors to see that they do their work; it comes to about 4,000*l.* per annum.

7048. That is a loss to the town of Leeds?—Yes; all the manure belongs to the contractors.

7049. Do you know what is the cost in Manchester?—It is much larger. It is 8,000*l.* or 10,000*l.* per annum.

7050. The gross cost is about 20,000*l.* and the net cost about 10,000*l.*?—I thought it was about 10,000*l.* When I was first chairman of the Nuisance Committee there was no system whatever of removing the night-soil in Leeds, everybody did as they chose with it. If anybody required the contents of their ashpit to be removed, they had to seek a farmer or hire some one to do it. The corporation, on the recommendation of the Nuisance Committee, took the whole thing into their hands and commenced cleansing the ashpits with their own staff, and it was in my judgment a foolish attempt at economy that led them to let the whole thing go out of their own hands into the hands of contractors. I am satisfied from experience, for I have watched how the contractors do their work and know how it has been done. I am satisfied that the work can be done much cheaper and very much better if it is entirely in the hands of the committee and council, than it can possibly be done if let out to a contractor who does it as slovenly as he can consistently with the terms of his contract.

7051. Do you know whether the scavengers levy a sort of black mail for removing those nuisances?—I know they do, because they make a mistake sometimes and they come to my own door.

7052. They watch their opportunity, and when the place becomes an intolerable nuisance they must be bribed, either by beer or a fee of some kind, to come and do what they are paid for doing?—That is so, so far as the workmen are concerned, not the contractors; but they say that the men very often do a thing of that kind—they object to clean a place out, if it is inconveniently situated.

7053. As a committee it would not come under your cognizance unless persons complained of it?—No; we should not know of it at all. In fact, we very seldom get to know of these extortions; we often have to publish notices in the papers requesting parties not to give drink and fees to the men.

7054. Is there much overcrowding in any parts of Leeds from want of cottage accommodation?—I believe we have a good deal.

7055. The growth of dwellings is not so rapid as the growth of the population?—No, especially in Leeds township.

7056. Have you any restrictive powers as to overcrowding?—Yes; we have now an Act. I think the Common Lodging Houses Act of last session has been extended, and we can apply it to more thoroughly to others than nightly lodgers.

7057. How do you raise your money for your building purposes?—Part of the members are depositors and others builders, and of course in proportion to the extent of our contributions are we able to lend out money for building purposes.

7058. At what rate of interest do you lend it?—Four and a half per cent.

7059. Are you acquainted with Mr. Torrens McCulloch's bill to erect dwelling-houses for the poor?—I have heard of it. It gives to corporations the power to do it.

7060. And enables boards of guardians to obtain money from the government at 3½ per cent. Do you think that such a scheme could be usefully adopted?—Yes, in a place like Leeds, where there is a great scarcity of cottage dwellings for the poor.

7061. Where houses are to be made wholesome there might be a low rate of interest?—Yes.

7062. You cannot expect to build comfortable cottages and get 10 and 15 per cent. on the outlay?—No. I may say that about a dozen of us formed ourselves into a cottage building society some years since in Leeds, and we set to work to build model cottages such as working men ought to live in, having three bedrooms and two lower rooms, a sitting room and a scullery. We built I think, six or eight blocks, from 12 to 20 houses in each block, selling them off for just as much as they cost us, letting the working men take them just at the price they had cost us, but we did not succeed in building houses that would let at the cottage rent.

7063. If you could have obtained an Act such as that contemplated from the State, and could have procured money at 3½ per cent., giving the property as security, could you have done any better?—I think we might.

7064. Have you any arrangement by which the men may redeem what has been expended in the building by paying an extra rental, and become possessed of the property after a certain number of years?—Not so far as we are concerned. Our intention has been just to build them and offer them for sale in a finished state, leaving the men to raise the money as they could; we have lent all the assistance we could. Several of us are members of a cottage building society, and we have asked the men to come to the building society and deposit there 30*l.*, and pay off the rest in thirteen years and a half.

7065. They would live rent free during that time, and pay in the shape of rent an annual instalment or monthly instalment to cover the interest and pay off the remaining part of the capital?—Yes. I may say that where men have taken these houses they pay a little more rent, but a very little more, through the building society than they would have to pay if the house was not to be their own in 13 years—sixpence or a shilling a week more. The house is their own all the time, that is to say, at the end of 13 years it will be their own, with the power during the whole of that time of disposing of it if they should fall into difficulty.

7066. Are there many common lodging houses in Leeds?—Not a large number, in proportion to the inhabitants, compared to other towns.

7067. Are they registered?—They are.

7068. And under the supervision of a common lodging-house inspector?—Yes. When the Common Lodging House Act was passed some years since, Mr. Newsome, a land surveyor, of Leeds, and I put it in force in Leeds, and during that time we had an opportunity of visiting nearly all the low lodging houses and nearly all the overcrowded dwellings in the town.

7069. What are your rates in Leeds now, the general district rate?—It is about one-third of the gross rental.

7070. Does that include the poor's rate?—Yes, and the highway rate and the improvement and every other rate.

7071. Is that high as compared with other towns in Yorkshire?—I think it is rather high.

7072. You have borrowed your money for the main sewers repayable in 30 years, have you not?—Yes.

7073. At what rate of interest did you borrow it?—I believe it has been principally borrowed up to this time at about 4 per cent., some of it I know has been borrowed at 3½ per cent.

7074. And you are gradually paying it off?—Yes.

7075. Therefore your heavy rates are added to by that repayment?—Yes, undoubtedly, and yet we go on expending money. The principal sum was to be 100,000*l.*, I think, for the main sewer, and 50,000*l.* for the branches; we are keeping up, I believe, about that sum, because we are carrying out now what you may call the branch sewers, having made the mains.

7076. Have you contemplated any utilization of your sewage; has it been brought to your attention?—In reference to our own it has not. I always thought that Leeds was very favourably situated as to utilization of sewage.

7077. You now pollute the river Aire, do you not?—Yes.

7078. Ought that to be allowed to go on?—I wonder it has gone on so long.

7079. You pollute the becks through the town; that is, the manufacturers do?—There is not a pure stream running now anywhere about Leeds.

7080. (*Mr. Harrison.*) Within how many miles should you say?—If you go beyond that point (*pointing to the map*) the streams will be pure. Manufacturers have not gone in the direction of Wetherby; to the south and south-west of Leeds all the streams are polluted almost to their source. I do not know of any except the becks coming down from the place I referred to that are pure; upon the becks that come from Headingley and that neighbourhood there are mills and tanneries, and they are polluted almost from their source.

7081. (*Chairman.*) If you do all you can to purify the becks in your own area, you would desire to see that some authority should carry out the same operation beyond you?—Certainly. I think that one rule should apply to all of us in that respect, and then it would be a less hardship.

7082. If rivers are to be purified, isolated measures will never do it?—Never. Some general measure must be introduced which shall deal with everybody, from the top to the bottom of every stream.

7083. What are you in business?—A coal merchant and a cloth finisher.

7084. In cloth finishing do you use water?—To a very small extent.

7085. Do you create any form of pollution yourself?—Cloth finishers do not create any; they merely put the gloss and face upon the cloth; the cloth comes to the finisher in a clean state, and no pollution is caused during the time he has it in his hands; if there is any pollution, it is when the cloth goes from the finisher to the dyer, but it comes to the cloth finisher clean and washed.

7086. As chairman of the Waterworks Committee I assume you know what the present supply of water to Leeds is?—Yes, pretty well.

7087. I presume you know the scheme of Mr. Filliter?—Yes, I do.

7088. You know the population of Leeds, and the volume of water which is at present pumped into Leeds?—Yes.

7089. And the source from which it comes?—Yes.

7090. Upon what grounds have you projected a larger scheme of water supply?—In the first place, our reason for leaving our present source is, that we do not think it pure enough for Leeds. Our second reason is, that our supply is getting fast exhausted, and the demand has increased so much; at the rate of something like half a million gallons a day per annum, that we anticipate in a few years, we should require a larger supply, and now when we are carrying out our works, we think that we really ought to lay them out for something like 20 or 30 years to come, and not be always tinkering with the question.

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7090*a*. The river Wharfe is a large river, I believe?—Yes.

7091. You have power to take out some 6,000,000 of gallons a day?—Yes.

7092. But you have never taken that volume out yet?—No; I think never.

7093. The cause of impurity is the drainage of Otley in the first place?—Yes.

7094. There are some tanworks there also?—Yes.

7095. And the drainage of some other villages and towns besides?—Yes; the drainage begins at Poole, just above our present works; there is a paper mill at Poole which turns out more filth than I would like to think about; at Otley you have the same thing; there is a large mill, and there is the sewage of Otley, and the manufactories of Burley and Addingham.

7096. Are you acquainted with the Thames Conservancy Act of last session for the purification of the Thames?—Not particularly.

7097. Do you know that the Thames is the source of water supply for five of the great companies supplying the west end of London?—Yes, above Thames Ditton.

7098. Do you know the amount of the population upon the Thames above that point?—No.

7099. Do you know that there are very large towns, like Oxford, Reading, and Windsor, on the Thames?—Yes.

7100. Do you know that there are clauses in the Act prohibiting the passing of sewage into the Thames after a certain time?—Not precisely. I have gone through a good deal of the evidence that was presented to Parliament in reference to sewage passing into the Thames above Thames Ditton.

7101. You have not seen the evidence presented to the Government by this Commission?—No.

7102. If all sources of pollution were stopped above your pumping station as they are to be stopped on the Thames, would that modify or alter your ideas as to your projected works?—It would not alter mine, because of the advantage in getting softer and better water. I do not think you ought to supply water to Leeds with 10° of hardness in it if you can get water containing from 2° to 4° within easy reach by an expenditure of some 10,000*l*. or 20,000*l*. or 30,000*l*. I should be for leaving the Wharfe to go to a better source, independently of all questions of sewerage. I was a member of the Waterworks Committee for 16 years, and I did my utmost in the town council to prevent us ever going to the Wharfe.

7103. Do you know the supply at Glasgow?—Only by report.

7104. Do you know that Glasgow formerly took its supply from the Clyde, just above the city?—Yes.

7105. I suppose you know that it takes it now from Loch Katrine, which is a pure source?—Yes.

7106. And that they have expended upwards of a million of money in doing it?—Yes.

7107. Do you know what Mr. Bateman calculates to be the saving in soap and other material?—I do not know what it is, but from my own calculations as to our own water, it must be very considerable indeed at Glasgow.

7108. Have you formed any idea as to what would be the saving in Leeds, between water with 10° of hardness and water with $2\frac{1}{2}$°?—Roughly from 15,000*l*. to 20,000*l*. per annum. When you deal with these figures people will hardly believe them; those who do not go into the question of saving in a day in soap, and in the wear and tear of clothes.

7109. What amount of money do you contemplate raising for your extended scheme now?—From 150,000*l*. to 200,000*l*., I believe, will be required to carry out our present contemplated scheme—that will be for 14,000,000 gallons—not for the entire scheme as indicated by the plans of Mr. Filliter. In reference to the river itself, my business premises are on the banks of the river Aire, and I have usually about 20 boats passing up and down the river; and in reference to that I may say that during the last 18 years there has been a very marked difference in the condition of the river Aire. You have the water coming down sometimes comparatively clear, I mean when it is tolerably still water in the river, you can see six inches or a foot perhaps by the side of the boats down into the water, but immediately that there is the slightest fresh then you get the filth down from above, no doubt from Bradford and all the towns up above, tumbling down the river. Immediately you get a thorough flood the river is abominable. It often stinks awfully just at the commencement of the flood, when the river begins to sweep down all the filth that has been deposited for weeks between Bradford and Leeds.

7110. When the flood begins to stir it up?—Yes.

7111. The sediment is deposited during the dry weather?—Yes.

7112. Then after the flood has gone by the river is in a better condition for a short time, is it not?—Yes, it is. Some questions were put yesterday to Dr. Chadwick, in reference to the death rate and birth rate. I will just put in a few figures that I have taken out of the Registrar General's returns for the last nine months. These figures refer to the death rate. I think it is calculated higher than it really is, in consequence of the increase of population not being taken sufficiently into account. In 1861 the birth rate in all England was 35 per 1,000. In London it was 35 per 1,000, and in Leeds, which was increasing very rapidly at that time, it was 38 in 1,000. In 1864, taking the population of 1861 as the basis in all these cases, the birth rate in England was 37 per 1,000, and in London it was 37 per 1,000, but in Leeds, in 1864, it had got up to 42 per 1,000; it had gone up five above the average of the country and of London. The birth rates this year and the last are about the same. Taking the population of 1861 as the basis, the birth rate of all England last year and this (taking the average of the nine months of the present year) is 38; London is 38; London city is 17; the West Riding of Yorkshire is 42; Leeds is 44; Birmingham is 43; and Liverpool is 36, with a death rate of 51, calculated on the same population. The Manchester birth rate is 36, with a death rate of 36, reckoned on the same principle. Sheffield has a birth rate of 47, 11 upon 1,000 above Manchester, and Bristol 33. At Settle, which is purely an agricultural district in our neighbourhood, and is perhaps the best sample of the district, the birth rate is 30 in 1,000. But what is very remarkable in Leeds, and what, in my judgment, shows that there is an immense increase in the population is this—Leeds proper, the township of Leeds, is one district according to the registrar's returns, Hunslet is an out district, Holbeck is another, and Kirkstall, which includes Burley, is another, and those three districts comprise that part of the borough of Leeds where there is the largest increase in the population. Now, the birth rate in Leeds itself is 42 or 44, independently of those out districts where the population is increasing at a very large rate. Holbeck, which is a separate district, has been divided from some other districts by the registrar general in order that he might know more particularly the death rate there. The birth rate in 1861 was 40 in 1,000; in 1864 it was 44; in 1865 46. In Kirkstall, which includes a very large population, and is in fact part of Leeds (Whittam's foundry is in Burley), in 1865 the birth rate was 47, and in 1866 it was 49. If you take Hunslet, a place where there has been the largest increase in any part of the borough, the birth rate in 1861 was 38; in 1863, 50; in 1864, 60; in 1865, 60; and in 1861, 61 in 1,000. What I have said before is that the register general is not giving us credit for the real amount of increase of population, especially in those out districts, and that if we reckon those births, and we say 38 births means 38 in 1,000 people, then there will be in Leeds 139,000 as the population, and if we reckon 38 in those three out townships, then we should have 125,000 of population, instead of 90,000, as we are credited with in the registrar's returns. I will put these figures in, having heard the evidence given by Dr. Chadwick on the point (*handing in the same*). In reference

to the drainage districts of Leeds, of Hunslet, and Holbeck since 1857, there have been 9,025 additional ratings, showing that there has been an immense increase in the population.

7113. That would represent, I suppose, about 50,000 people ?—About that, but that is only in the drainage districts of Leeds, Hunslet, and Holbeck, it does not include Wortley, which is a most thriving place, and Burley. The rateable value has increased in proportion.

7114. (*Mr. Harrison.*) The borough of Leeds altogether has increased more largely than most towns in England from the commencement of this century ?—I think so.

7115. That increase has not arisen from people being born in the borough so much as from the influx of people from other districts ?—That is so, in order to supply the large ironworks which have been established in the last 10 or 15 years with hands.

7116. That influx would be of young people comparatively, would it not ?—Yes.

7117. And you might expect a larger birth rate from an increasing population of that kind than you would from a town in a permanent condition ?—Yes, certainly.

7118. Can you tell me whether the manufactories that are carried on in Leeds employ a great number of the females of Leeds ?—Yes, they do ; some manufactures especially.

7119. Are you sufficiently acquainted with Birmingham to say whether, in proportion, there is a similar number of females employed there ?—I do not know.

7120. If you have manufactories that employ more females, as compared with Birmingham, that may account for the death rate to some extent ?—I cannot account for the difference in any other way ; it must be owing to something of that kind. The death rate of Leeds will be higher, I think, than the death rate of Birmingham. There are some very unhealthy trades in Leeds, I think.

7121. Which are they ?—Especially the flax trade. In flax mills children and young women often work amongst dust which must be very injurious to their health; that is in one part of the flax mills. In another part of them they spin their threads through hot water, and the young women stand with their mouths and nostrils very near the hot-water trough. It runs the whole length of the spinning frame, and there is a constant dropping from the thread down on the ground, and I cannot but imagine that those young people must be to some extent injured by breathing such an atmosphere. Where you have such a large number of these steam troughs with hot water in connexion with the spinning frames, the temperature of the whole room is so altered that it must injure the young people who work there to a certain extent.

7122. And those young people are chiefly children and young women ?—Yes, they are nearly all Irish now, the class of young people that live in the worst parts of the town, and who would be most liable to disease. English girls have had facilities for the last few years of getting to the power-looms in connexion with the worsted business and with the cloth business, and they are getting to be employed with the sewing machines in large towns like Leeds. English girls have almost entirely got into better occupation, and those flax mills, where there is such a large amount of dust and heat and steam, are filled almost entirely with the children of the lowest class of people.

7123. You would say that the rapid increase of Leeds, arising from the influx of young people to supply the wants of the manufacturers, would account in a great measure for the increased births, as compared with many other towns, especially country towns ; and that the unhealthy occupation of many of the females would account in some measure for the increased death rate ?—Yes, I think so.

7124. You stated just now that the cleaning out of the cesspits of Leeds cost about 4,000*l.* a year ?—Yes.

7125. Mr. Filliter yesterday in his evidence mentioned that if you carried out any system of sewage irrigation, you must provide pumping power for about 10,000,000 gallons a day, raising that quantity 25 feet, at the rate of 12*s.* 6*d.* per million gallons, or in all 6*l.* 5*s.* a day ?—Yes.

7126. Therefore from that it would appear that the cost of pumping all the sewage at present passing down, as contemplated by Mr. Filliter, would not amount nearly to the sum you at present pay for carting out a part of the ashes and the contents of the cesspits ?—No, certainly not.

7127. That those cesspits are a source of ill health to the town is admitted, I suppose ?—They are a great abomination in Leeds, Manchester, Sheffield, and nearly all those towns.

7128. Therefore, the argument seems to be most decidedly in favour of the corporation of Leeds taking some steps to have those cesspits done away with, and apply the sewage to the land ?—With that view we have got a clause inserted in our last Act to compel owners of property to construct waterclosets instead of privies and ashpits. We take power as well to compel parties to fill up their sumpts, and it would be a great blessing if all of them were abolished.

7129. You think that by that means you would have increased health at no extra expense, and possibly a diminution of your expenses ?—Yes, I think that what the Town Council expended the Board of Guardians would save.

7130. As the inspector of nuisances stated yesterday, wherever he finds these pollutions most rife, there he finds the relieving officer in closer attendance ?—Yes, no doubt of it.

7131. With regard to cottages that you are building, what area do you have attached to each cottage for garden ground ?—In nearly all cases we have given a small garden in front, and a back yard, with a separate petty in it. Some three or four yards at the front and the same at the back ; every house has a separate and distinct entrance into its own garden, and a separate and distinct entrance into the back yard.

7132. Would it not be desirable that you should have it provided that that should not be built upon ?—Yes, I think so.

7133. You have stated that almost all the streams in the neighbourhood of Leeds to the south-west are polluted ?—Yes.

7134. And are becoming more and more polluted every year ?—Yes.

7135. So that the question as to whence water is to be derived for the supply of the increasing population becomes one of very great importance ?—It does. I may say that the increase of manufacturies has been such in Leeds that every now and then we are all of us obliged to go deeper down with our boreholes for water for ordinary purposes. Somebody comes and builds a mill next to you and sinks a well a few yards deeper than yours, and then you must go lower than he has gone.

7136. Have you a deep well that you pump from ?—Not on my premises.

7137. Mr. Filliter stated yesterday that the Low Moor Iron Company have a pumping establishment at Beeston, and it was thought that they pump now to such an extent as to affect the pumping in Leeds. Have you any information upon that point ?—I believe that, but there are other people besides those at Beeston. There are pumps going on the other side of Leeds, and those all tend to draw the water away from the valley, and we constantly find parties applying to us, the waterworks company, to supply them with water while they are making their wells a little lower. That is so every year, and is becoming more so year by year.

7138. The dip of the strata is from you ?—Yes.

7139. So that anybody pumping in that direction is likely to leave you dry ?—Yes, for the last eight or ten years that has been the case; the richest men have got down the deepest and so spoiled some of the smaller ones. Such firms as Messrs. Marshall's, Tetley's, the

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Old Forge Company, and several others, go down deepest and dry out their neighbours.

7140. And you are driven towards the north-west to obtain a large water supply of some kind?—Yes; and it is very important that we should have really a good supply, as the manufacturers will be more and more dependent upon the waterworks for their supplies.

7141. That is at the bottom of the question of going further for a larger and softer supply of water; your manufacturers are more likely to require that water?—Yes.

7142. Can you give us some information as to the 20,000*l.* that you calculate saving from obtaining a supply of softer water?—I have not any figures at present here, but I will supply them to you.

7143. (*Professor Way.*) Do you remember how much you set down to soap and how much to tea?—I think about one-half.

7144. It is clear that until you can get lather from the soap the soap is wasted, but it is not equally clear that because you do not get a dark-coloured tea you have wasted your tea; you make a stronger-coloured tea, and you get what we call more matter out of the tea; but whether you get any greater benefit from the tea, except the look of it, is a question?—I cannot answer that question. I was told by the clerk to the guardians that they have, by sinking a well of their own, got very soft water, and that they are ceasing to use the town's water, and that they have saved 40*l.* per annum in soap. I take it that in the workhouse, where there is a definite number of people always living, and washing going on, if you can save that, it is easy to calculate what a population of 250,000 would give in saving at the same rate.

7145. You stated before that when the river is tolerably quiet, and there is no fresh for some time, the water becomes clear for a foot or two from the surface?—Six inches down. We have just had some very heavy floods within these last two or three weeks, but when the river becomes still again you will find nearly all the sewage of the towns above Leeds settling in the bed of the river. When the dyers are not making very free use of the water, which is the case sometimes, especially in the morning, you will have the water appearing tolerably clear, but as soon as it is a little stirred by the flood, down comes the sewage.

7146. You mean to say that there is a sediment as distinguished from the coloured water?—Yes.

7147. Would not that encourage the hope that some measures may be taken in the different manufactories to separate that sediment before it is thrown into the river?—It would be a great benefit if it was done, it is a terrible waste now. It would be a great benefit to some of the manufacturers if they would take out their soap that they turn out into the rivers from scouring cloth and wool, instead of turning all of it into the streams.

7148. Supposing that an individual manufacturer, without waiting for any general accord or any legislation, were now at a moderate expense to purify the water, is it not just possible that the water so purified might be better for his use than the river water?—That I do not know.

7149. (*Chairman.*) Do you filter the water that you pump from the Wharfe?—Yes.

7150. With a sand filter?—Yes.

7151. Is that the best sample that you can put before the Commission (*pointing to a bottle*)?—One reason we have for going for a better supply is because the water of the Wharfe is sometimes very peaty; that is the peaty water of the Wharfe in the bottle.

7152. Do you believe that the Washbourn water is better than the Wharfe water?—We may be induced to take some steps, if it is not better, to take out the peat effectually, which I believe we can do at an expense of from 20,000*l.* to 30,000*l.*

7153. (*Professor Way.*) Or otherwise to keep it from getting in?—I think there would be great difficulty in doing that; if it could be filtered through the hills before we got it it would be all the better.

7154. (*Mr. Harrison.*) Have you gone into the question of expenditure for water per head by the population; for instance, if a person has an average supply of 16 gallons per head, how is that used in the household?—I think a large quantity is used that we do not get paid for. I think the better classes of houses, some of those that have baths and waterclosets, use a large quantity above their share in proportion to what they pay for.

7155. It is a very important point where water is becoming so scarce?—Yes; I find that all other large towns and large water companies have the same difficulties to deal with; all of them have a very great leakage that they cannot account for or find out. Our consumption is about 16 gallons per head, including what goes for manufacturing purposes and brewing; about one-sixth of the quantity goes for manufacturing purposes.

7156. (*Chairman.*) What is your rate of charge for private consumers upon the rental?—Five per cent.

7157. Do you think that persons who pay a higher rental use proportionately more water?—Yes, if they are in the same circumstances as my friend here, Mr. Filliter; we shall have to put him a meter on.

7158. (*Mr. Harrison.*) I suppose the town is so locally divided between quarters for the poor and quarters for the rich that you might place the meter so as to determine by experiment how much per head was used by the poor population as compared with the rich?—I think that might be done if you tested a district like Headingley, and then a district like Holbeck, where you have nearly exclusively cottage property.

7159. (*Chairman.*) Do you supply the hotels by meter?—No, on the rentals, and the number of waterclosets and urinals, I think.

7160. (*Mr. Harrison.*) Have you observed the river recently, after standing still on Sunday, or after three or four holidays?—No, I have not perceived any difference at those times.

7161–2. At Whitsuntide I presume they very frequently clear out the ponds, so that the river might be really more polluted although the mills are not at work?—Sometimes they do, I daresay; but there are very few ponds I think above us of that class that need cleansing. It is not with us on the Aire as it is above Huddersfield. They have to cleanse very differently; at least their dams are not of such a large size.

Mr. Ald. D. Yewdall.

Mr. Alderman DAVID YEWDALL (of Calverley, Leeds,) examined.

7163. (*Chairman.*) Are you a native of Leeds?—No, I live at Calverley.

7164. You are an alderman of the borough?—Yes.

7165. How long have you been a member of the corporation?—Seven or eight years.

7166. What business do you carry on?—I am a cloth manufacturer.

7167. Where is your manufactory situated?—I have one at Calverley and another at Bromley.

7168. Are they on any stream?—Calverley is situated on the river Aire, and the other is in Bramley, situated on no river or beck.

7169. What number of hands do you employ at the Calverley mills?—I can scarcely tell you. We scribble, and slub, and spin, and put out a good deal of work for men to weave. At Calverley we pay weekly rather more than 100*l.* for wages, and we pay perhaps 150*l.* at Bramley. Besides that we have a large number of people employed out in weaving, to whom we pay in wages about 250*l.* weekly. I should say that altogether we cannot have less than 1,000 people employed, young and old.

7170. How long do you remember the river Aire?—For 34 or 35 years.

7171. In what condition was it when you first remember it?—Much better than it is now. It is much fouler now than it was.

7172. Do you use water for any purposes in the manufactories?—Yes, for scouring the cloth.

7173. Can you use the river water now for that purpose?—No, not exactly. When I first knew the river Aire I could have drunk it, it was quite bright.

7174. As good as this in this bottle (*pointing to the same*)?—Yes, I think so; it has got worse every year for these last 34 years.

7175. That is, gradually, and if left alone it will continue to get worse?—No doubt of it, as manufactories and population increase.

7176. Do you know Bradford beck?—Yes.

7177. Is that a source of nuisance to you?—I should think that is perhaps the principal cause of the foulness of the river.

7178. What form of nuisance does that beck send down?—There are all kinds of nuisances caused by the manufactories and dyeworks. Then there is the general nuisance of the whole town, such as water-closets. The worst time is when there has been a dry time, and then comes a strong shower of rain or a thunderstorm, the stream will come down then as black as possible.

7179. Stirring up the sediment from the bed of the river?—Yes. If we have a lot of cloth we have to wait five or six hours before we dare scour a piece at all—before we dare pump water from the river. I have seen sometimes, when we have put a piece into the scouring machine, that it has come out almost black.

7180. It has come out in such a condition that you could not do anything with it?—It had to be scoured over again.

7181. That is of course a serious loss to you in trade?—Yes.

7182. Do you know what that would amount to in 12 months?—We take care not to have much loss if we can help it. What I have mentioned is mere accident, but it is a great inconvenience, because we sustain a loss in time.

7183. And interruption to the business?—Yes; my trade is principally white cloth dyed for light colours, and it is very important to have pure water—clean, soft water.

7184. Do you get any water from the water company?—At Bramley we do, from the Leeds Water Company.

7185. Do you know what volume you get per week?—I know I paid altogether rather more than 100*l.* last year. Bramley is in the borough, and we pay 6*d.* per 1,000 gallons. If I could have the town's water at Calverley and pay for it by meter, I should certainly take it.

7186. Why cannot you have it?—Because the place is out of the borough.

7187. If you could get it at 6*d.* per 1,000 gallons you would use it?—Yes.

7188. If the river was pure I suppose that would not be necessary?—No, I should only use the town water occasionally; perhaps at a cost of 10*l.* or 20*l.* a year.

7189. If the water was as bad as the Bradford beck, could you carry on your manufactures with it?—No, I could not, except by getting another supply; but I do not think it is likely to be so bad.

7190. Do you use engine power at your works at Calverley?—Yes.

7191. What weight of coal do you use per year?—I can scarcely say. We have sufficient water power when there is water, but the water power varies according to the seasons. We have had very little occasion to use steam this summer. We have not wanted it since July. It has been a peculiar season, very wet.

7192. You make a certain amount of ashes I suppose?—Yes.

7193. What do you do with them?—We never put them into the river.

7194. Do any of your neighbours do so?—I think not.

7195. Have you never seen them thrown into the rivers or streams?—I do not know that we have.

7196. Are you at all troubled with floating carcases and drowned animals?—Yes, we have many of them.

7197. Dead dogs?—Yes.

7198. Are they a nuisance?—Yes, they are, in the river. We see them float over the dam stones. I should think that there are almost more dead dogs in the canal than in the river. They are very bad indeed.

7199. Do you use much soap for scouring at either of your works?—Yes.

7200. What weight per annum do you use?—I can scarcely tell you, but we use a great deal of soap. We pay perhaps 100*l.* a week for soap and oil.

7201. (*Professor Way.*) Is there any attempt made to extract the grease afterwards?—Yes, I sell the waste liquor to a party and he extracts the oil and grease.

7202. Does he do that on your premises?—Yes.

7203. Does he deal with the whole bulk of the washing water or only with the best portions?—As a rule I think he takes nearly the whole.

7204. Does he receive it in tanks?—Yes.

7205. You allow him a certain space upon your premises to carry on that work?—Yes.

7206. He adds something to it I suppose, some acid?—Yes.

7207. What is the name of the person?—Mr. Wilkinson.

7208. Does he press that material that he gets on your works or take it away?—He takes the grease away when he has extracted it.

7209. You have no presses by which you can press out the oil?—No.

7210. Where are his works?—I think they are in Bramley township.

7211. What is the nature of the liquid that runs away from the tanks?—It is not very bad then.

7212. Not worse than it was when he began with it?—It is a great deal better.

7213. Is a large quantity extracted in that way. What proportion of the 5,000*l.* that you spend for oil and soap is got back again?—I cannot tell you. We do not pay in the year for soap so much as 5,000*l.* at this mill.

7214. (*Chairman.*) Do you know how much you get for your waste?—Yes, 50*l.* a year.

7215. (*Professor Way.*) Are the tanks very large that he collects this liquid in?—Not very large.

7216. As big as this room?—No.

7217. How often are they filled and emptied in a day?—That I cannot tell you; he takes his own course.

7218. Supposing it was desirable that you should take that into your own hands, would there be any difficulty in selecting an intelligent man amongst your workmen to superintend it?—I do not know I am sure.

7219. Is it possible that you might get more than 50*l.* out of it if you did so?—Very likely. We used to let it all run to waste, and we thought that what we should get for letting it was so much saved, 50*l.* a year.

7220. If you were called upon to do so, you might be able to change the liquid for the better before it was discharged into the brook or into the river?—I cannot answer that question.

7221. It is not clean water?—No, but I do not think it is objectionable after the grease has been extracted. It is astonishing what a difference the process makes.

7222. (*Chairman.*) Do you know how much a year is obtained throughout Yorkshire for soap waste?—I do not.

7223. Would you be surprised to hear that 100,000*l.* a year is now being paid for soap waste?—No, I do not think that I should.

7224. And that at least, according to intelligent calculation, there is another 100,000*l.* worth which might be utilized, as small mills do not utilize it, and some large ones likewise?—Just so.

7225. Therefore out of that refuse alone Yorkshire might be 200,000*l.* a year better than it was formerly?—I should not be at all surprised at it.

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7226. (*Professor Way.*) If the system of extracting the grease could be improved, I suppose that those figures would be a great deal below the truth?—It looks very strange to get only the small amount that I get for the quantity of soap which must be in the water.

7227. If the profits now obtained by the grease collectors are moderately fair, must it not be that they do not extract by any means a fair per centage of grease out of that water?—It would appear so.

7228. Either their profits are enormously great, and the manufacturers receive much too little for the grease, or the grease is wasted and is lost in spite of the process?—Yes.

7229. If a larger quantity by better dealing with these liquids could be saved from waste, would it not be a fair thing that a part of that increased profit, whether it came to the manufacturer or to the grease maker, should be devoted to the better purification of the waste water which is finally thrown in?—I do not see but what it would.

7230. (*Chairman.*) Do you know what price parties get for the material so extracted?—I do not.

7231. Do you know that some parties are paid upon the amount extracted, and not by a rental?—I do not know that.

7232. (*Professor Way.*) Does all the soap and grease actually go away in the water. Do you dispose of any wool which has grease in it, short wool, or shoddy, or anything of the kind?—Yes; that is a very important thing, and I should think that a great proportion of it is waste, it falls under the machine.

7233. What becomes of it?—We sell it, we call it food.

7234. Is it food for the extraction of grease, or not?—I believe that it is food for the extraction of grease, and that a part of it is worked up and made into a low sort of cloth.

7235. Do you know of any establishments for the extraction of the grease from that food?—Yes. I should say that a very large amount of grease goes into that waste that falls under the machine. I should say that that is the greasiest part.

7236. Can you tell us how much of that goes away from your mill?—I cannot; it is a largish weight.

7237. Could it be ascertained?—Yes.

7238. I suppose that if we could ascertain that, and could learn how much oil on the average it contained, we should have the means of calculating how much went in that way and how much in the other?—Yes.

7239. It is, then, only fair to the grease makers to say that they have not the opportunity of getting out all the grease?—That is quite right. I should say that the best part of the grease which they get is in the first scour. We scour the cloth twice. We scour it with grease, and then we what we call burl it, and then we mill it up into cloth and then scour it again. In the first scour we wet the pieces in urine and pigs' dung. The first scour must have the largest amount of olive oil in it, we grease the wool, there is scarcely anything but olive oil, and for the first scour the extractors are most particular. They will get a larger amount from the first scour than from the latter one. There is no soap in the first scour, but in the latter scour it is principally soap. There will be only the oil which comes from the soap, which will not be so valuable, nor will there be so much of it.

7240. Do they treat the two scours separately?—No, they both go into the same tank, but they know by the colour one from the other.

7241. I suppose that when the oil is used alone they would have no necessity to make it acid?—I do not know. I should think that they have, but I really cannot tell you. The food is very heavy and very greasy.

7242. Are you aware that they extract that oil from the food not only by pressure but with a substance called bi-sulphide of carbon, which is very stinking?—I do not know.

7243. (*Chairman.*) Does the retention of the waste fluid cause any nuisance on your premises. I refer to the tanks?—I do not know that it does.

7244. Do your workpeople use open privies or waterclosets?—Open privies.

7245. Do you cleanse those open privies yourselves?—Yes.

7246. What becomes of the refuse?—I have a considerable portion of land, and I dress my own land with it.

7247. Do the contents of any of the waterclosets fall into the river?—We have not many waterclosets.

7248. You have open privies?—Yes.

7249. Then you do not pollute the streams with that form of refuse?—No.

7250. Do you use human ordure in the scouring or milling processes?—We use urine.

7251. But not the solid refuse?—No.

7252. Is it not used in some processes?—Yes. I have known it used when pigs' dung was very scarce, and there is no doubt that it has first-rate scouring properties, but it is very seldom used; it is very objectionable to use it.

7253. On account of the stench?—Yes.

7254. (*Professor Way.*) Do you ever use salts as substitutes for pigs' dung and for urine?—Yes, we use a little in scouring wool.

7255. Do you know what the salts consist of?—No.

7256. What do you give a ton for them?—You can get them at various prices. We have tried salts frequently, but, as I heard an old gentleman once say, "They may try what they like, nothing can compare "with pigs' dung and wash," that is urine, "and mottled "soap and olive oil." We have found that in many colours, such as scarlet and all light colours, we have never so bright a colour as by the use of those things.

7257. (*Chairman.*) The ordinary use of pigs' dung, human urine, mottled soap, and olive oil, gives you the most certain result?—Yes, the most certain colours, and it is very important to have soft and pure water; hence, if the river Aire keeps getting worse, manufactories will want a larger supply of pure water every year for manufacturing purposes.

7258. (*Mr. Harrison.*) Do you carry on the whole process at each of the mills?—We carry on the whole process at each of the mills; as I told you before we scour cloth twice. If the water is bad the first time that we scour a piece of cloth and we do not get a proper scour (we give it the name of a bottom scour, which is a thorough scour), the little grease which is left will perhaps take two or three pounds of soap extra to get the cloth up, and I do not think that it will ever be as bright, or of as good a colour, as if it got a thorough scour the first time.

7259. Something is fixed in the cloth?—Yes.

7260. What is it which is fixed?—The grease which has never been removed. I mention that to show that the river is getting continually worse, and that unless the river can be altered Leeds will require a larger supply of pure water every year.

7261. (*Chairman.*) Has any portion of the fine trade of Leeds been interfered with or driven away in consequence of the impure state of the water?—I should think not. At the same time there is no doubt in the world that they can dye better colours in the west of England than we can.

7262. There is a place called Galashiels, is there not?—Yes, in Scotland.

7263. Is it true that the manufacturers there have taken some of your fine manufactures from you?—I am not aware of it. I think not on account of the water.

7264. Then is it on account of the brains of the Scotchmen?—I suppose so. I should say that their trade is principally what we call a fancy trade.

7265. I have been told that they can get in the market a price for their goods which you would in vain attempt to get for Yorkshire goods?—I have been in Scotland, and I believe that in Scotland they are very particular about cleansing the yarn and getting bright colours; there is no doubt of it.

7266. (*Mr. Harrison.*) Do they use as much shoddy?—I have not asked them that question.

7267. Have you made any experiments as to the effect of using soft water as compared with other water in the quantity of soap which you have to use?—Yes.

7268. Alderman Carter said that you would be able to give us some exact information upon the subject?—That is what I have stated. Supposing that you have a superior water and a soft water, and can get a really good scour in the first instance, it will save you a good deal in soap.

7269. But you do not know exactly how much?—I should not wonder if it would save me 50 lbs. weight of soap a day, but that is supposing that the scour under existing circumstances has not been good; a scour is always liable to be bad with bad water.

7270. What quantity of wool do you manufacture daily or weekly at your two mills?—We never send out less than what we call stones; I should say 100 stones a day at each mill, 16 lbs. to the stone.

7271. That will be 3,200 lbs.?—Yes; perhaps there will be 3,500 lbs. weight in a day at the two mills.

7272. What quantity of water do you require to cleanse that wool and the cloth afterwards?—I really cannot say.

7273. I understand that you have no river to go to?—No.

7274. You must either pump water or you must get it from the waterworks?—We have wells and pumps, but besides that we pay more than 100*l.* a year to the waterworks.

7275. Cannot you give us the quantity of water which you have to use in all your processes?—I cannot, it is very large. For instance, we have very large cisterns, we pump the water from the river and we scour the wool in a hot liquor, and then put it into one of these large cisterns with a false bottom; we work the wool about in the water.

7276. By the force of the water itself?—Yes; that requires a very large amount of water.

7277. And you use it without stint?—Yes, at Calverley. At Bramley we should be at a tremendous cost if we had to get that water from Leeds. At Bramley, because we are short of water, we have only through rollers.

7278. Do you find any difference in the degree to which you can cleanse the wool in those two processes?—I would rather cleanse it by the first process if we could get plenty of water.

7279. Can you get wool thoroughly clean by rollers?—Pretty fairly so, but I would rather have the other process.

7280. Do you make very fine cloth?—Not particularly fine; with rollers there might be some particles of sediment left, but I do not think that that is anything really objectionable.

7281. If the Aire is going to be so polluted that you must go to the water company to purchase, you would very soon use as little water as you possibly could?—You are quite right.

7282. And again when the water is polluted the less quantity which you have to deal with in order to purify it the better?—The river Aire has been very good this summer.

7283. In consequence of the flood?—In consequence of the flood; it is worst in summer. With a very dry summer, such as we have had the last year or two, it has scarcely ever been clean, and I have seen it effervesce at the dam stores as if malt was working, and we could scarcely get any clean water for some weeks. We tried to remedy it by putting in a pound, but nothing would remedy it except a flood.

7284. (*Professor Way.*) When you say that the river has been very good this year, I suppose that you are speaking of the river as compared with its general state?—Yes.

7285. But it is not very good water?—It is pretty fair. When we have continual rain we have a great quantity of rain water; rain water as you are aware is soft, and it comes further up; and such a quantity mixes with the Bradford beck and the other becks that we scarcely see the pollution.

7286. I thought that that was the time when these flushes brought down impurities from Bradford and other places?—Yes, that refers to the first flush; we cannot scour till the first flush has gone.

7287. I suppose that if the sources of pollution were to cease the river would soon get tolerably clear by these flushes; the natural causes would flush out the river, would they not?—Yes, I have no doubt that they would.

7288. (*Mr. Harrison.*) When you are cleaning your wool at Bramley with the rollers, what quantity of water do you put in to a certain weight of wool?—I cannot tell you that; we use that water not for wool scouring but for milling. We take a little sometimes, but as little as we can.

7289. Up at Bramley you are rather stinted of water, you have either to pump it or to buy it?—Yes.

7290. Down at the river you get as much as you like?—Yes.

7291. In the one case you use it economically, and in the other case you use it wastefully?—Yes.

7292. If you could give us the quantity of water which you use at those two places it would be useful information; would it entail much trouble to get it?—I scarcely know, I could make inquiries.

7293. Do you send much polluted water away from your mills?—Not much after the extract; I do not think that it is very bad then.

7294. Have you ever tried putting it on the land?—It runs down into the river, we cannot irrigate.

7295. Cannot you do so at Bramley?—I have no land at Bramley; but if we could do so I have no doubt that it would be beneficial.

7296. (*Chairman.*) Have you any further observations to offer?—The great source of the pollution of the river, so far as we are concerned, is Bradford beck; it is a great injury to Leeds, and if Bradford increases in the next 30 years as it has increased in the last 30 years, the river Aire in the summer in a dry time will be something like a main sewer. What is the remedy I cannot tell you.

7297. (*Mr. Harrison.*) You consider that Leeds itself is seriously and injuriously affected by pollutions coming from the upper parts of the river?—Yes. For instance, there is a beck which runs down by us; there is not much water, and I have seen that beck almost as bad as Bradford beck. There is no doubt that there are small villages which pollute the small tributaries of the river.

7298. How are the small villages off for water; I refer to villages which are on the borders of the Aire?—Bradford, in their last Waterworks Act, got power to embrace a large area with many villages, and that no doubt has been a capital thing.

7299. But those villages which are beyond those limits come second-best off?—Yes; the pipes of the Bradford Waterworks do not go to the other side of the river.

The witness withdrew.

Mr. William Hammond Bartholomew (Leeds) examined.

7300. (*Chairman.*) You are engineer to the trustees for the undertakers of the Aire and Calder Navigation?—I am. The plan which I now put in shows the extent of our jurisdiction.

7301. For how many years have you been engineer to that body?—I have been 14 years connected with them as engineer.

7302. Do you remember at what date the navigation works commenced; they are, I see, very old?—Yes, the commencement of them was in 1698; the old navigation is entirely done away with, and the new one has been twice improved.

7303. Have the Aire and Calder trustees a beneficial interest?—They have.

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7304. Then it is a company?—Yes.

7305. The proprietors have subscribed their capital and receive dividends?—They do.

7306. Is the traffic as great now as it was at any former period?—It is greater in tonnage.

7307. The railways have not driven the tonnage from the navigation?—No, except in some articles of a higher class.

7308. Then your navigation would differ in a very material respect from the Thames, where the carriage of goods has been almost annihilated?—Yes; we are increasing in tonnage yearly.

7309. What class of goods do you usually carry on your navigation?—Coal and corn are the staple articles; we also carry stone.

7310. Ironstone?—Very little ironstone.

7311. Building stone?—Yes, flags and building stone; we carry a large quantity of manure, limestone, and lime and salt.

7312. Do you carry pottery?—Pottery ware, and also a considerable amount of high-class goods, bales, and merchandise traffic, which has specially been a traffic of late years.

7313. Is that in consequence of your giving by your branches and arms greater facilities to warehouses than are afforded by railway arrangements?—Partly so, and partially from the ready means of shipment at the port from the vessel to the steamer; the vessel goes alongside the steamer at any point where it may be, whereas the railway trucks may not do so so conveniently.

7314. What length of time does it take to get goods by your boats from the higher parts of the navigation down to the port of shipment?—We commence at Leeds, and the distance from Leeds to Goole is 36 miles, and to Hull it is 25 miles additional. We ship at Goole in about nine to ten hours after leaving Leeds, and in three hours after that, namely, in 13 hours, we ship at Hull.

7315. Then goods put on board to-day at Leeds may be on board ship to-morrow?—I have known cases where they have left at 8 o'clock in the evening and have been on board at Hull at 11 on the following morning. We always run during the night.

7316. That would be one of the secrets of your continued success against railway competition?—No doubt. We frequently get goods down at the port at the same time as the railway does.

7317. Railways can give no greater facilities as regards time than you can?—Certainly not between those parts.

7318. What amount of dredging power do you regularly employ now upon your navigation; what number of dredges have you?—We have three at present engaged; two are constantly working and one partially, and we are constructing a fourth.

7319. What amount of dredging power did you use when you first came on the navigation; have you increased it during your engineership?—Yes. I have known the navigation for some years. My father preceded me. During that time we had a small 10-horse dredger, that is going back 25 years ago, subsequently to that time it was replaced by one of about 30-horse power; it did the work for about 15 or 20 years, and we have now added another of about 25-horse power; and we are again about to make a duplicate for that.

7320. Then you will have nearly 100-horse power?—We shall.

7321. But formerly when your father was engineer he only had 10-horse power?—Yes. I should state that under our Act of 1820 we took powers to make the navigation a seven feet navigation, whereas before that it was only five feet.

7322. Then a considerable amount of dredging has been for the purpose of creating and maintaining an extra depth?—Yes; but the extra depth has been completed for the last 20 years, so that you may take the present dredging power as solely what is required to maintain it.

7323. Do you know the Clyde?—I do.

7324. I believe that a great addition to the depth of the Clyde up to Glasgow has been obtained by dredging?—I believe almost solely.

7325. And a great annual expenditure is required to maintain that depth?—Yes.

7326. Are your rivers and canals more polluted now than they were 20 years ago?—Very much so.

7327. From increase of manufactures upon the banks?—Undoubtedly.

7328. Under your Acts have you power to restrict fouling or polluting of the rivers?—No; that is confined to our own navigation.

7329. You have power as conservators to prevent the putting in of solids?—Yes, rubbish, coal dust, ashes, or anything of that description.

7330. Do you ever exercise that power?—We have found very great difficulty in doing so. I do not think that much solid refuse is thrown in on our own line proper; the great difficulty which we have is in dealing with what comes to us through the different tributaries.

7331. Those are beyond your jurisdiction?—Yes.

7332. In your dredging operations do you find that you have to remove ashes and slag which are passed in from different works?—Yes, ashes in particular, and I may say that that undoubtedly is on the increase.

7333. Do you find that ashes are an injurious obstruction, that they clog with the sand and choke up the channel?—They do. Wherever the river happens to be wide, we always find ashes deposit at every flood, and we have more or less to remove them. I may mention in connexion with the cuts that we find that there is a large increase of dredging at the entrances to the different canals. Many of them are on a level with the summit of each pool, and during the lesser floods the flood waters get into the cut, and the matter in suspension precipitates at the head of the cut; we find this deposit to be on the increase. You may say that the increase has been 20 per cent. during the last five years, and that is going on, showing that the amount of sewage matter and other lighter refuse is largely on the increase.

7334. Are you much troubled by dead carcases floating into the canals and rivers in the portions which you navigate?—We have been. I do not think so much so in the last two or three years as previously. I think that steps have probably been taken by the authorities to avoid that.

7335. Have your dredgers any instructions from you to remove floating carcases when they see them?—Occasionally.

7336. No stringent regulations are, I suppose, imposed upon them to cleanse or scavenge the river?—No.

7337. Are there no regulations upon the canals for removing floating carcases?—We ourselves do it, but there is no other authority; we always remove them and bury them.

7338. What is the length of your navigable canal?—I can give you the rivers and perhaps the canals; the river Aire from Leeds Bridge, where our jurisdiction commences, to Weeland, where it ends, is 40 miles and 2 furlongs. The Calder from Sowerby Bridge, the point to which we have now jurisdiction under a lease which we hold of the Calder and Hebble, to its junction with the Aire at Castleford, is 37 miles and 1 furlong, so that we have a total length of 77½ miles. We have also upwards of 80 miles of canal.

7339. What is your draught?—From Goole to Leeds, and from the former place to 6 miles above Wakefield, we have 7 feet 6 inches, that is the admissible through draught. Above this latter point to Sowerby it is 5 feet, and from Wakefield to Barnsley it is 6 feet.

7340. What is the heaviest tonnage which you can deal with?—We have improved the navigation by enlarging our locks between Goole and Castleford; that admits vessels of large size. There are now vessels carrying 160 tons; but above the point of those improvements 100 tons is the limit. Above Wakefield 60 tons is the limit.

7341. (*Mr. Harrison.*) You have a branch to Selby?—Yes, for the York traffic, that is six feet.

7342. (*Chairman.*) What is your rate of tonnage for carriage of coal?—It varies from a halfpenny to a farthing per ton per mile, according to the character of the coal and the district.

7343. Do you allow any carriers to carry upon your canals, or are you yourselves exclusively the carriers?—We encourage other carriers as much as we can. Traffic which cannot be well carried in competition with the railways by individuals we carry ourselves.

7344. Do you know the Bridgewater Trust?—I do.

7345. Is your traffic managed in a somewhat similar manner to the management by that trust, namely, that you encourage independent carriers, and are carriers upon your own account?—Precisely so.

7346. You have your own boats and your own warehouses and your own men?—Yes.

7347. And there are independent carriers who pay you by tonnage or rental?—Yes.

7348. Do you know what it is costing you per annum for dredging?—Yes; leaving out the capital account, the Aire has cost us from 800*l.* to 500*l.* a year. You may say an average of 650*l.* a year.

7349. What do you do with the material which is dredged out?—With the material dredged out, the solid matter, the gravel, and so on, we fill up sundry diversions of the river which we have made. With regard to the mud out of the canals, we dispose of it, if we can, to farmers, but this has been done to a very limited extent, or we raise land with it.

7350. Do you find a sale for the mud?—It is very limited indeed; it is not found to be very beneficial to land unless it is very peculiarly treated, and not many of the farmers are aware of it; it requires some experience to deal with it.

7351. I suppose that it wants to be put through a process of rotting if possible, so as to kill the weeds which it contains?—Partially so, and the surface also must be well washed with rain and exposed, so as to remove or neutralize the chemical ingredients which it contains; and then it is very productive.

7352. Have you kept any rain gaugings at any points upon your navigation?—Only at one point, namely Goole.

7353. Have you a table of the rain gaugings for any length of time?—Yes, I have it for about six years.

7354. Have you made an abstract of it?—I do not happen to have it with me, but I can furnish it.

7355. I see that you have some written papers, what are they?—Those are dredging statistics which I hand in showing the amount and cost of dredging in each pool and each river. (*See papers printed at the foot of the evidence of the witness.*)

7356. (*Mr. Harrison.*) For a series of years?—For the years 1840, 1850, and 1855, and then consecutively from 1856 to 1865. Singularly enough in the Calder there is not an increase, but in the Aire there is a very large increase. I ought to explain that in the Calder we have trained the rivers, narrowed them, and given them a uniform section, with a view to diminish the amount of deposits, and that has been so beneficial as to reduce the deposits of ashes in the Calder.

7357. Have you a large amount of dredging near the junction of the Aire with the Calder?—It gives us great trouble.

7358. (*Chairman.*) Are there any cloth manufactories situated upon the banks of your navigable canals?—I do not know a single instance on the canals now; they are chiefly on the banks of the river.

7359. Do you sell water from your canals at any point for manufacturing purposes?—We do.

7360. Have you a fixed form of rent, is it by the 1,000 gallons or by the horse power?—It is by the nominal horse power.

7361. Do you sell it for cleansing or washing or dyeing?—We limit it to steam-engine purposes, although I believe that in some few instances it is applied to dye purposes.

7362. What is your charge for steam purposes?—15*s.* per horse power per annum.

7363. I suppose they take it by a pipe, or pump under your control?—Yes, and they return it to the same pool from which it was taken.

7364. The water after being used has to be thrown back?—Yes, into the same level.

7365. Do they use it both for generating steam and for condensing?—Yes.

7366. Then the heated water comes back into the canal?—Yes.

7367. Do you find any cause of nuisance from that heated water coming in?—Possibly during the hot weather it has some tendency to stir up the gases.

7368. Do any villages, or towns, or manufactories, or separate houses, drain closet matter into any portions of the canals?—Not into the canals proper.

7369. Did the undertakers at any time receive a rental for fishing in the streams and canals under their jurisdiction?—No; generally speaking the landed proprietors secured the rights of fishing in the canal.

7370. They were secured to the landowners through whose estates the canals passed?—Yes.

7311. Is there any fishing now in any portion of the canal property?—It is almost extinct; there are some few fish in the lower part of the canal near Goole, but in all the upper portions the water is so contaminated that there are none. Salmon frequently used to come over the Haddlesey dam, and I believe did so up to the last year, and there was a fishery at the foot of the dam, but that has now ceased altogether.

7372. Have you had the Salmon Fishery Commissioners here?—I believe not.

7373. You yourself have not given evidence before them?—No. I believe that the Aire is included in a commission which is going forward.

7374. Do you know Leeds pretty well?—I do.

7375. Had you any application made to you before the outlet sewer of Leeds was passed into the Aire, down below the town; were you at all consulted about that construction?—It was prior to my joining the navigation.

7376. Do you think that you would have power to interfere in any way or to impose conditions upon towns wishing to sewer direct into the navigable parts of the river?—We should certainly object to that.

7377. Would you have power to object effectually?—We should oppose them in Parliament if they had a bill to make a special line of conduit.

7378. You would wish to place restrictions upon them, that they should not pollute the river, or bring down solids?—Yes.

7379. (*Mr. Harrison.*) Have you occasion to dredge the river Aire below the outlet of the Leeds sewer?—Before it comes into a navigable part of the river the sewage has to run from the outlet some four or six miles; then, no doubt, every flood removes it to the points which we dredge afterwards.

7380. I see that by your return the annual expense of dredging varies very materially in different years?—Yes.

7381. In a very flooded year, for instance, this year, you might not dredge at all, or to a very limited extent?—The fewer floods the less dredging we have; the more floods the more dredging they bring us.

7382. Then you are dredging during the continuance of a flood, or subsequently to it?—We have not sufficient dredging power, and therefore we dredge the whole time.

7383. Your dredger told us that when the water gets above a certain height, about nine feet, he cannot dredge any longer?—He cannot dredge then in the river; six feet in the river would stop him. We have one dredger which cannot dredge above 12 feet; we have another dredger which can dredge 18 feet, which can dredge at any time.

7384. In two fine consecutive years, like 1864 and 1865, you would probably have a small amount of expenditure in dredging. In 1865 I see that you have only an expenditure of 465*l.*?—Yes, that is taking that particular year; that is owing to another exceptional

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cause. In that year we had considerable dredging at Goole, which took our dredgers away from the river, and not having sufficient dredging power we got into arrears.

7385. The quantity which you have to dredge depends upon the floods; they form banks, and you have to remove them?—Yes; it mainly depends upon our ability to remove them on account of our inefficient staff.

7386. Under your Acts there are Commissioners of the Aire and Calder appointed?—We have Commissioners under our powers.

7387. Is it not their duty to look after the undertakers of the Aire and Calder Navigation, in order to see that they do their duty, and to intervene in making any arrangements for purchase or entry?—That is under certain Acts; the Commissioners have not power under the whole of the Acts.

7388. Do the Commissioners exist at present?—They are an extinct body at present.

7389. From what cause is that, is it because they have not been called into operation?—They have not been called into operation, I think, since 1776. I am corrected, I understand that in 1815 they were called into operation.

7390. They are a body who can be found if they are wanted, even to the present day?—Yes.

7391. But they are not called into active operation unless they are applied to?—No.

7392. Have they simply to arrange matters between the undertakers and others?—They have to adjust damages.

7393. Can you give us the fall at the different locks in summer time, and the fall of the river itself in different parts?—Yes. I will furnish a statement of them to the Commissioners.

7394. Have you at any time taken gaugings of the volume of water passing down the Aire and Calder?—Not specially so, but in a great measure I have the means of ascertaining it. I have recorded the heights of each flood; in fact the varying heights of the water daily in each pool; that has now extended over some four or five years; during that time I can give you the state of the river and the length of the weir board, so that the information can be very approximately got, except in extreme floods, when the river overflows its banks, and thus outflanks the weirs.

7395. Can you give us the length of the weir at the junction of the Aire and Calder, and the daily height of the pond above that weir for four years?—Yes.

7396. Are there any disturbing circumstances which would interfere with the calculation in the ordinary way?—Not materially, except in the extreme cases mentioned.

7397. Do those weirs to which you would refer us fall out of action in flood time?—They do partially; that is to say, they backwater up a little; in other words, the upper and lower pools in high floods become nearly level.

7398. Will it make much difference in the maximum quantity?—Yes. There is also another consideration—we have falling deals in that particular dam which are struck in flood time, and that would somewhat militate against an absolutely correct return.

7399. Have you the height above and below the weir?—Not at that particular point, but I have the height of that particular pool; that, however, is at a distance of five miles.

7400. If you can give us an actual section of the river and the fall of the water in the maximum floods it will enable us to correct the maximum?—I think that I can give you the information pretty closely.

7401. (*Chairman.*)What is the influence of heavy floods upon your navigation?—They rarely do us any damage. They obstruct the traffic, that is the main objection to them.

7402. Have you noticed whether the floods are as heavy now as they were when you first knew the river?—I should say decidedly not.

7403. To what would you attribute that circumstance?—Partially to collecting reservoirs. Later in the season a few hours rain brings a flood down.

7404. (*Mr. Harrison.*) After the earth is saturated?—Yes, whereas in summer time it takes a great deal of rain to bring a flood down.

7405. (*Chairman.*) Do you think that land floods are at all influenced by the drainage operations?—Yes, in the Aire floods do not remain so long as they did. The soil does not act as a sponge as it used to do, but the water is discharged almost at once into the river and we have it much more rapidly.

7406. (*Mr. Harrison.*) Is any such effect attributable to the improvements which have been made above Keighley?—No, I do not see that there has been any such effect, so far as we can discern.

7407. Have you calculated from any data which you have the maximum and minimum volume of water passing down the Aire and the Calder?—I have not, but I will give you that information.

7408. Have you used steam power upon your canals and rivers for towing?—Yes, extensively.

7409. Do you find it successful?—Yes, extremely so.

7410. Does it injuriously affect your banks?—No. Experience has shown us the speeds at which we should run to avoid that, and we limit ourselves to those speeds.

7411. What is your speed?—The speed is $4\frac{1}{2}$ miles upon the canals.

7412. And upon the river what is it?—Where the sectional area is larger we run at a speed of six miles. It entirely depends upon the sectional area of the water.

7413. What do you find to be the cost of towing goods by steam as compared with horses?—In our carrying traffic, taking four years, the average is $2\frac{1}{2}d.$ per boat per mile. Each boat may take about 30 tons.

7414. What would it be if you used horse power?—Our horse power by contractors is $7\frac{1}{2}d$ against $2\frac{1}{2}d.$

7415. Then do you think that the introduction of steam power in the place of horse power, on the Thames, for instance, and other rivers, would seriously affect the question of the competition of railways?—Certainly. We could not at all compete with the railways with horse power.

7416. And although railways are abundant in the neighbourhood you can successfully compete with them with the assistance of steam power?—Yes. No navigation in the kingdom has so many railways opposing it or running in competition with it as ours has. We have been put to our resources, and we have endeavoured to make the best use of them.

7417. (*Chairman.*) Do you use paddles or screws?—Screws entirely.

7418. In what part of the boat is the screw fixed?—For the goods traffic, the traffic which we conduct ourselves, we have a specially arranged boat with the machinery aft, and the boat carries cargo forward. The steam power occupies the after cabin, and that really is the secret of the success of so much reducing the cost, namely, combining the carriage of cargo with towing.

7419. Have you seen any account of propulsion by the ejection of water?—Yes.

7420. Do you think that that might be applicable to canal traffic?—It is difficult to say. It is in its infancy. I do not think that it is applied in the best manner now.

7421. What is the actual sectional dimension of your canals?—Our top width is from 60 to 66 feet, and there are batters of two to one, and a bottom width of 20 feet.

7422. Are there road bridges spanning your canal?—Our bridges were originally contracted to the width of our locks. In our improvements we have taken out those bridgeways and improved them in all cases.

7423. Have you not to slacken your speed to four miles an hour at the bridgeways?—Yes.

7424. You are obliged to have larger bridgeways or to ease the speed ?—Yes.

7425. Have you ever run swift boats on your navigation similar to those which are run on the Forth and Clyde and the Bridgewater canal; I mean swift boats by horses running at nine miles an hour ?—Yes, but they did not long remain.

7426. They did not pay ?—No, the passenger traffic was not such as to make them pay.

7427. You have of course seen them in motion ?—Yes.

7428. Have you ridden upon them ?—Yes. There is an interesting matter in connexion with towage which we are doing. I have spoken of our tugs in connexion with the carrying trade, but we have other tugs of much larger power for the public. We tow for the public in a great measure. You may take the cost as one-tenth of a penny upwards and one-twelfth of a penny downwards.

7429. And that is a cost which pays you interest for your outlay and working expenses ?—Yes. We have now tugs upon our rivers up to 150-horse power.

7430. Have you tried the double screws ?—We use an application of my own, viz: two screws on one shaft some distance apart; the after screw having the larger pitch, so as to absorb the slip of the first one.

7431. Have you tried the double screws ?—Yes, I have seen them a good deal and experimented with them, but they are not so efficient as one screw of large diameter where you have an adequate depth of water. We have a considerable draught of water.

7432. How long have you towed by steam power upon your navigation; do you remember what was the earliest date of your doing so ?—You may go back nearly 30 years; it was by paddle tugs; it used to cost us 10½*d.* a mile by those tugs.

7433. Did you ever see the small steamer which was upon the old river at Manchester, worked by a screw ?—No.

7434. The locks are very short there; of what length are their locks ?—The general length is about 72 feet. We are improving our locks to 206 feet.

7435. You would find it an advantage to tow with longer boats, and therefore to have longer locks ?—Yes, partially so. Our object in lengthening the locks was twofold, to admit more than one boat at a time, and also to facilitate large tonnage, seagoing steamers, and so forth.

7436. Are your gates of wood or iron ?—They are of wood on the navigation, and they are of iron at the dock gates at Goole.

7437. (*Mr. Harrison.*) What time does it take you to pass boats through the locks ?—Through our original lock you can do it in three minutes with care, but the average time is five minutes.

7438. (*Chairman.*) What volume of water would it consume ?—About 9,000 cubic feet.

7439. Have you any side ponds at any of your locks upon the canals ?—We have not.

7440. You have never been driven to that in order to maintain your water ?—No. Through the new locks we pass the vessels and empty these large locks in quite as little time as we do the lesser ones.

7441. Do you use Armstrong's hydraulic apparatus at any of your docks or warehouses ?—We do.

7442. Do you find it of advantage ?—Very great. We open now in three minutes, whereas formerly it took us nearly fifteen minutes.

7443. And it is merely by a man turning a small handle ?—Yes.

7444. At what pressure do you use your water ?—We started with 700 pounds, but we have now got up to 850 pounds, in consequence of a very large new lift which we have put up.

7445. There would be from 1,500 to 1,800 feet of head ?—Yes. We have introduced a new mode of dealing with coals, similar in point of principle to that which is used by the railway companies; compartments containing from 30 to 35 tons of coals, seven of which form a train, are conveyed to the port of Goole, at which place they are hoisted up to the requisite elevation and tilted into the ship.

7446. The hydraulic machinery affords you great facilities for carrying on your business ?—Yes.

7447. It transmits power much better than any other mode ?—Yes, at the distant points.

7448. You get your pressure by what is called an accumulator ?—Yes.

7449. (*Mr. Harrison.*) In several places you have cuts cutting off long bends of the river ?—Yes.

7450. Have you control over the river which you leave out in that case ?—We have.

7451. Do you do anything towards maintaining the depth or removing any shoals which occur in those parts ?—We limit our dredging to places over which our traffic goes.

7452. Do you know any parts where the river has silted up to any extent in those bends ?—No, I think not.

7453. It was mentioned that about Dewsbury the bed was raised, and that in consequence the flooding of the adjoining lands was greater than it used to be, has any such thing taken place here ?—It is necessary to receive those assertions with great caution. As this is a coal basin, whilst miners are constantly getting the coal beneath, the surface will subside three or four feet.

7454. So that flooding may be caused not by the river bed being raised, but by subsidence of the land ?—Yes, in many cases.

7455. Have you ever found your canal or river dip down in that way ?—About Barnsley we have. They cannot work the coal to the injury of the navigation.

7456. You have powers of inspection of the mine ?—In all cases.

7457. Have you a complete survey of the works ?—In the places about Barnsley where they have power to get the coal, unless we elect to purchase. I keep the plans posted up to enable us to raise the banks, and to provide for the settlement.

7458. (*Chairman.*) Have you had the canal let down near Barnsley by coal workings underneath ?—Yes.

7459. Have you had any breakage of the banks from that cause ?—We have had escapes of water, but have not had any banks carried away. One place has been very troublesome. The bottom of the canal is rock, and was excavated rather shallow to begin with; it is covered with a puddle lining, and fissures in the rock keep opening and letting the puddle through them, as the removal of the coal proceeds, and we have constantly escapes into the valley below.

7460. Have you had any actions threatened for letting the water into the land below ?—No.

7461. To what extent at any particular point have your canals gone down ?—The seam of coal which is worked there is nine feet, and we have had a maximum subsidence of six feet.

7462. And then you simply raise the banks of the canal ?—Yes; we fill up the bottom of the canal with puddle and raise the bank. There is a contrivance which we have introduced into our navigation in the way of sluices, which as a matter of information might be useful; it is a sort of self-balancing sluice, so that no power is required either way. It is a simple self-balancing sluice on the Dutch plan improved.

7463. A sort of throttle valve ?—Yes. If the culverts are made in a specified form it will both open itself and close itself by just giving a start. We have them up to 63 feet area.

7464. Did you ever go down to Birkenhead to see the dredging operation out of the great float there ?—Yes.

7465. Do you know that they all failed ?—Yes.

7466. The admission of water in a large body through sluices is not to be trifled with ?—Certainly not, especially in the manner in which they employed it without a floor of any sort.

7467. It was an entire failure ?—Yes, it must necessarily have been.

The witness withdrew.

PAPERS put in by W. H. BARTHOLOMEW, Esq., C.E., Engineer to the AIRE AND CALDER NAVIGATION (referred to supra, Question 7355).

AIRE and CALDER NAVIGATION.—COMPARATIVE STATEMENT of DREDGING, 1845 to 1865.

RIVER AIRE.

Date.	Leeds Pond.	Fly Boat Basin.	Leeds Cut.	New Basin.	Knostrop Pond.	Knostrop Cut.	Hunslet Pond.	Leeds Canal.	Methley Pond.	Castleford Junction.	Castleford Cut.	Castleford Pond.	Total.	Amount. Dredging.	Boating.	Hauling.	Total.
	C. Yds.	C. Yds.	C. Yds.	C. Yds.	C. Yds.	C. Yds.	C. Yds.	C. Yds.	C. Yds.	C. Yds.	C. Yds. Beal Pond	C. Yds.	C. Yds.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1845	108	—	720	—	216	—	1,728	1,224	432	—	756	—	5,184	64 14 3	135 0 11	27 0 0	226 15 2
1850	1,440	—	72	—	288	—	1,116	—	2,542	—	180	—	5,638	46 14 1	184 18 11	29 7 3	261 0 3
1855	—	—	—	—	—	—	—	—	—	350	180	540	1,070	7 12 0	19 2 6	5 11 5	32 5 11
1856	1,692	—	576	—	5,102	—	972	2,664	324	2,880	—	—	14,210	118 3 0	357 2 5	74 0 2	549 5 7
1857	—	—	—	—	—	—	—	—	1,260	1,368	72	2,497	5,197	51 7 6	133 8 2	27 1 4	211 17 0
1858	5,676	1,107	1,197	—	3,711	1,116	1,368	4,201	36	900	5,220	—	24,532	147 2 3	483 13 0	127 15 5	758 10 8
1859	2,232	612	576	288	4,212	—	756	504	1,512	4,068	—	—	14,760	104 11 0	276 19 2	76 17 6	458 7 8
1860	—	—	—	—	144	252	—	1,656	3,780	2,844	864	72	9,612	75 7 9	156 19 10	50 1 3	282 8 10
1861	1,224	—	1,668	—	2,268	—	1,404	2,500	5,508	—	360	108	15,040	116 14 4	331 13 7	78 6 8	526 14 7
1862	180	—	36	—	2,484	396	1,044	—	1,296	—	6,768	216	12,420	82 19 6	219 15 8	64 13 9	367 8 11
1863	3,804	540	1,548	—	4,212	216	864	3,060	828	4,560	2,586 Beal Pond.	622	22,840	141 16 0	499 11 6	118 19 2	751 6 8
1864	4,548	576	1,080	1,332	5,328	1,548	1,032	1,116	762	2,196	1,248	1,374	22,140	175 14 0	509 2 8	115 6 3	800 2 11
1865	1,590	—	—	—	72	—	288	2,526	3,552	1,023	2,274	735	12,060	116 9 0	277 5 10	62 16 3	456 11 1
Five years average from 1856 to 1860	1,920	344	470	58	2,634	273	619	1,805	1,382	2,412	1,231	514	13,662				
Five years average from 1861 to 1865	2,269	223	866	266	2,873	432	927	1,841	2,389	1,556	2,647	611	16,900				

Total yards on Aire and Calder Navigation.	
1845	24,840
1850	25,228
1855	20,686
1856	22,526
1857	16,789
1858	40,136
1859	25,236
1860	21,966
1861	29,519
1862	22,752
1863	42,244
1864	30,993
1865	22,776

Total Aire and Calder averages.	Total yds.
Average of four years 1855 to 1858 -	25,034
„ „ 1858 to 1861 -	29,214
„ „ 1861 to 1865 -	29,691
River Aire.	
Average of five years 1856 to 1860 -	13,662
„ „ 1861 to 1865 -	16,900
River Calder.	
Average of five years 1856 to 1860 -	6,336
„ „ 1861 to 1865 -	5,174
Goole Canal.	
Average of five years 1856 to 1860 -	5,332
„ „ 1861 to 1865 -	7,582

NOTE.—Raking and spooning not included in the above.

	Cost per Cube Yard of River Aire. Dredging.	Boating.	Hauling.	Total.
	d.	d.	d.	d.
1845	2·99	6·25	1·25	10·49
1850	1·98	7·87	1·25	11·10
1855	1·70	4·29	1·25	7·24
1856	1·99	6·03	1·25	9·27
1857	2·37	6·16	1·25	9·78
1858	1·40	4·61	1·25	7·26
1859	1·70	4·50	1·25	7·45
1860	1·88	3·91	1·25	7·04
1861	1·86	5·29	1·25	8·40
1862	1·60	4·24	1·25	7·09
1863	1·49	5·15	1·25	7·89
1864	1·90	5·51	1·25	8·66
1865	2·31	5·51	1·25	9·07

(Signed) W. H. BARTHOLOMEW.

Comparative Statement of Dredging on the Aire and Calder Navigation, 1845 to 1865.

RIVER CALDER.

Date.	Foundry Shoal.	Foundry Shoal. Railway Bridge.	Calder Cut.	River at Bottom Boat.	Stanley Basin.	Fairieshill Basin.	Fairieshill New River.	Pottery River.	Methley Pond.	Total.	Amount. Dredging.	Amount. Boating.	Amount. Hauling.	Amount. Total.
	C. Yds.	C. Yds.	C. Yds.	C. Yds. 4,032 for improvement under Act of 1828.	C. Yds.	C. Yds.	C. Yds.	C. Yds.	C. Yds.	C. Yds.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1845	6,574	—	2,844	2,210	—	—	3,996	—	—	15,624	164 11 5	577 19 0	65 2 0	807 12 5
1850	5,076	—	1,836	—	1,152	—	—	—	—	8,064	59 17 11	267 5 2	33 12 0	360 15 1
1855	1,296	1,908	2,700	216	360	—	—	—	2,232	8,712	80 13 10	207 2 4	36 6 0	324 2 2
1856	1,296	1,944	2,376	—	1,152	—	—	—	1,548	8,316	76 18 0	166 3 1	34 13 0	277 14 1
1857	396	612	—	—	—	324	—	1,800	828	3,960	19 9 0	43 8 5	16 10 0	79 7 5
1858	3,276	648	—	—	—	—	—	—	—	3,924	29 0 3	71 13 6	16 7 0	117 0 9
1859	1,368	3,528	1,296	756	972	—	684	—	1,872	10,476	76 17 3	203 9 10	43 13 0	324 0 1
1860	540	2,664	180	252	540	324	504	—	—	5,004	57 11 11	117 12 1	20 17 0	196 1 0
1861	—	—	—	—	—	—	—	2,340	3,816	6,156	24 5 3	84 5 2	25 13 0	134 3 5
1862	1,224	2,520	—	—	—	180	252	—	360	4,536	37 10 3	87 0 8	18 18 0	143 8 11
1863	—	—	—	—	—	612	—	1,926	1,248	3,786	22 13 6	59 9 5	15 15 6	97 18 5
1864	—	1,980	426	—	792	210	—	—	—	3,408	28 16 6	60 17 0	14 4 0	103 17 6
1865	1,440	864	1,626	—	1,548	—	—	2,508	—	7,986	72 5 0	155 15 2	33 5 6	261 5 8
Five years average from 1856 to 1860.	1,375	1,879	770	202	533	130	238	360	849	6,336				
Five years average from 1861 to 1865.	533	1,073	410	—	468	200	50	1,355	1,085	5,174				

	C. Yds.
Five years average, viz., from 1856 to 1860	6·336
,, ,, ,, 1861 to 1865	5·174

Note.—Raking and spooning not included in the above.

	Cost per Cubic Yard. Dredging.	Boating.	Hauling.	Total.
	d.	d.	d.	d.
1845	2·52	8·87	1·0	12·39
1850	1·78	7·95	1·0	10·73
1855	2·22	5·70	1·0	8·92
1856	2·22	4·80	1·0	8·0
1857	1·18	2·63	1·0	4·81
1858	1·77	4·38	1·0	7·15
1859	1·76	4·66	1·0	7·42
1860	2·76	5·64	1·0	9·40
1861	0·94	3·28	1·0	5·22
1862	1·98	4·60	1·0	7·58
1863	1·43	3·77	1·0	6·20
1864	1·67	4·28	1·0	6·95
1865	2·18	4·68	1·0	7·86

(Signed) W. H. Bartholomew.

1715.—2.

LEEDS.

W. H. Bartholomew, Esq.

8 Nov. 1866.

PAPERS put in by W. H. BARTHOLOMEW, Esq., C.E., Engineer to the AIRE and CALDER NAVIGATION (referred to supra, Question 7355).

COMPARATIVE STATEMENT of DREDGING on the AIRE and CALDER NAVIGATION 1845 to 1865.

GOOLE CANAL.

Date.	Knottingley Junction.	Knottingley Cut.	Goole Canal.	Total.	Amount.			
					Dredging.	Boating.	Hauling.	Total.
	C. Yds.	C. Yds.	C. Yds.	C. Yds.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1845	Nil.	Nil	Nil	Nil	Nil	Nil	Nil	Nil
1850	2,160	3,384	5,982	11,526	108 4 8	254 2 5	48 0 6	410 7 7
1855	3,168	7,736	Nil	10,904	97 19 9	231 16 6	45 8 8	375 4 11
1856	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
1857	—	2,916	4,716	7,632	65 4 1	155 14 0	31 16 0	252 14 1
1858	—	972	10,708	11,680	103 12 2	217 18 8	48 13 4	370 4 2
1859	—	Nil	Nil	Nil	Nil	Nil	Nil	Nil
1860	—	3,400	3,950	7,350	50 1 1	135 4 10	30 12 6	216 18 5
1861	—	4,737	3,586	8,323	51 19 6	192 9 5	34 13 7	279 2 6
1862	2,340	Nil	3,456	5,796	45 14 0	96 4 2	24 3 0	166 1 2
1863	Nil	14,250	1,368	15,618	132 18 3	311 13 3	65 1 6	509 13 0
1864	—	2,382	3,063	5,445	43 3 0	95 0 10	22 13 9	160 17 7
1865	—	792	1,938	2,730	22 16 0	51 17 3	11 7 6	86 0 9

Five years average viz.: C. Yds.
from 1856 to 1860 - 5,332
" " " 1861 to 1865 - 7,582

NOTE.—Raking and spooning not included in the above.

Cost per Cube Yard for Goole Canal.

	Dredging.	Boating.	Hauling.	Total.
	d.	d.	d.	d.
1845	Nil	Nil	Nil	Nil
1850	2·25	5·29	1·0	8·54
1855	2·15	5·10	1·0	8·25
1856	Nil	Nil	Nil	Nil
1857	2·05	4·89	1·0	7·94
1858	2·12	4·47	1·0	7·59
1859	Nil	Nil	Nil	Nil
1860	1·63	4·41	1·0	7·04
1861	1·49	5·54	1·0	8·03
1862	1·89	3·98	1·0	6·87
1863	2·04	4·78	1·0	7·82
1864	1·90	4·18	1·0	7·08
1865	2·0	4·55	1·0	7·55

(Signed) W. H. BARTHOLOMEW.

Mr. T. Wilson.

Mr. THOMAS WILSON (Leeds) examined.

7468. (*Mr. Harrison.*) I believe that you are secretary to the Aire and Calder Navigation?—I am general manager of the Aire and Calder Navigation.

7469. How many years have you been connected with it?—24 years.

7470. What was the condition of the rivers Aire and Calder when you first knew them, as to purity?—Very different from what it is at present, I am sorry to say. That was previous to the sewage of Leeds being poured into the river, and previous to the sewage of Bradford (which comes down the river from the upper part) being poured in.

7471. Within that period there has been a very great increase of manufactures in the neighbourhood?—Yes.

7472. We heard at Wakefield that within that period fish were abundant in the Calder?—Yes.

7473. Were they so also in the Aire?—Yes.

7474. Up to Leeds?—Nearly up to Leeds.

7475. The Aire and Calder Navigation has existed under Act of Parliament for a considerable period?—The first Act was passed in 1698, the second in 1774, the third, which only relates to the Goole Canal, in 1820, and the fourth in 1828. I have brought all the Acts except the Goole Canal Act. This being only for a canal, I do not know that it bears upon the inquiry, but I can easily send it if the Commissioners require it.

7476. Will you give us as well the Goole Canal Act?—I will take care to send it. I have marked on the margin, and at the head of it, the clauses which relate to the general powers of the undertakers, so far as they seem to bear upon the present inquiry.

7477. Under those Acts what power have you to prevent the pollution of the river?—I think we have no power as to pollution unless it takes the form of solid matter, then we have ample power within our own jurisdiction; but we suffer most from the tributaries being foul, and from the water being polluted there, and clogged also with ashes, which are thrown in to a large extent where we have no jurisdiction to prevent it.

7478. Although the tributaries bring a large portion of solid pollution, such as may not be thrown into the river where you have jurisdiction, you cannot prosecute?—No, and that has been the case at Bradford, where the canal, I suppose, will be shut up, because it cannot supply itself with water except from the Bradford beck, which is in a bad state, and still they cannot prevent the pollution of the Bradford beck by any indictment under the common law.

7479. To whom does the Bradford canal belong?—To a body of shareholders.

7480. Is it a canal between Bradford and Leeds?—It is only three miles long, and it falls into the Leeds and Liverpool canal at Shipley, and so is connected with Leeds.

7481. Has it hitherto been able to stand against the competition of the railways?—Yes.

7482. And to carry on a considerable traffic?—And to carry on a very considerable traffic.

7483. Do you know that it is likely really to be stopped in consequence of an injunction against it as to the supply of water?—The proprietors say that they must do so, that they have no alternative.

7484. That they have no other source of water supply excepting from the Bradford beck?—Yes. There is an injunction against their taking the waters of the Bradford beck after the 4th of this month.

7485. Do you exercise the powers which you possess in restraining people from casting ashes and different things into the river?—We should do so if it took place within our jurisdiction to any great extent.

7486. We found that either the dread of a prosecution or an actual prosecution had the effect at Wakefield of preventing their putting the ashes into the

river ?—Yes, but it does not prevent them here laying ashes on the banks of the river in such a position that the floods may undermine the heap and carry it into the stream. I think that perhaps it would be difficult for us, under the present state of the law, to deal with a case of that kind, and that the law should provide for it.

7487. There are ashes actually carried into the river in the neighbourhood of Leeds, over which you think you have not sufficient control ?—We have called the tatention of the parties to it, and they have generally desisted, for a time at any rate. We have never prosecuted in such cases.

7488. The river Caldér is embanked a good deal on both sides, is it not, in places ?—Yes.

7489. Was that done by the Aire and Calder navigation undertakers ?—I think not, if it was it was done for the purpose of improving the navigation.

7490. Are the flaps under the bank, and the different things which keep the water from flowing back upon the land, under the control of the navigation company ?—I do not at this moment recollect any flaps under the bank.

7491. One was mentioned to us near Thornhill, where they said that the land had been flooded for some time, and they blamed the Aire and Calder Company for allowing a bank to be formed against the flap so that it could not act ?—That would be on the Calder and Hebble Navigation, of which we have been lessees only about two years, and I do not think that our attention has been called to that, or we should have remedied it.

7492. Have you a copy of the Calder and Hebble Navigation Act ?—I will give you copies of those Acts. There are three of those Acts in force at present.

7493. Are there any further points to which you wish to call our attention ?—The only point which occurs to me is the question whether some alteration of the law could not be introduced which would give parties interested the power of preventing the filling up of streams by rubbish, or other matter of that kind.

7494. Do you think that the Aire and Calder Company would be the proper persons to entrust with the power of preventing the pollution of the river within their jurisdiction ?—I think that they should be empowered to be complainants if they suffered from it ; but that the remedy should be by penalty enforced by the ordinary magistrates.

7495. I suppose that they could now proceed against any person sending any refuse into the river, could they not?—Within their jurisdiction I think they could.

7496. Do you wish to have the power enlarged beyond your jurisdiction, so that you might become complainants at Huddersfield or Bradford ?—Certainly, if we could prove that the act was injurious to the navigation. It matters not where the evil arises, whether it is within a few yards of the river, or whether it is miles above.

7497. Although Mr. Ferrand could trace the Keighley slag opposite his property, I am afraid that there would be a doubt as to where it came from when it got down below Leeds ?—The law can go no further than throwing the onus of proof upon us, which no doubt is difficult. I think that if a sufficient penalty were imposed the fear of it would be enough to prevent the injury to the streams.

7498. You should be spared the burden of proving that the piece of slag which you have to dredge out below Leeds came from any particular spot, and be enabled to proceed if you found people casting refuse into the river at any part ?—Yes ; we might send watchers to any particular part.

7499. Do you think an extension of the powers of the Aire and Calder Company over the entire navigable area, powers, in short somewhat similar to those lately given to the Conservators of the Thames navigation up to Cricklade, would be a desirable thing ?—Do you mean for navigation purposes ?

7500. Not only for navigation, but for preventing pollution ; I include power to proceed against town authorities or against individuals for putting any objectionable refuse into the river ?—I do not recollect whether the Act gives them the power or merely makes them complainants. I imagine that in our case it would be quite sufficient to give us the power of complaining before the magistrates.

7501. That would make the act punishable ?—Yes, by the ordinary magistrates.

7502. You being allowed to become complainants ?—Yes.

7503. Do you think that in that case it would be your interest to exercise a kind of watch over the entire area ?—I have no doubt it would, not a continuous one, perhaps, but the knowledge that we had the power and the fear of the penalty would to a great extent protect us.

7504. The saving of the expense to which the Aire and Calder Company are annually put in the shape of dredging would recoup and possibly more than recoup the expense of keeping persons watching and of prosecuting offenders ?—Yes.

7505. (*Chairman.*) Is there anything further which you would wish to add to your evidence ?—No, nothing further occurs to me. If anything, however, should occur to the Commissioners it will be the desire of the directors that we should give every possible information and assistance which we can in this inquiry.

The witness withdrew.

Mr. George Tatham (Buslingthorpe) examined.

Mr. G. Tatham.

7506. (*Chairman.*) You are an alderman of the borough of Leeds ?—I am.

7507. Do you carry on any business in the borough of Leeds ?—Yes.

7508. What is that business ?—It is the manufacture of sheep, calf, and goat skins, and glue manufacture.

7509. It is not termed tanning ?—It is not known by that name. Tanning is a simple process compared with ours ; we dye and finish.

7510. And you produce the material which I am looking at ?—Yes.

7511. What is this leather used for ?—For bookbinding, hat lining, portfolios, table-tops, carriage furniture, and almost everything. We call ourselves sheep leather manufacturers, and also glue makers.

7512. (*Mr. Harrison.*) Is the process which you carry on subsequent to Mr. Nickol's dividing of the sheep hides ?—Tanning is generally confined to heavy hides. We are especially skin manufacturers ; we prepare and tan and dye and finish our goods.

7513. (*Chairman.*) In what part of Leeds are your works situated ?—They are situated upon the Sheepscar beck at Buslingthorpe.

7514. What number of hands do you employ ?—About 360.

7515. Do you use steam or water power, or both ?—We use steam power only.

7516. Do you use much water in the processes of your trade ?—Yes, we use about 100,000 gallons a day.

7517. Where do you obtain it ?—We have facility for pumping about half of it, and we use at least as much from the Sheepscar beck.

7518. For what purpose ?—The water from the beck we principally use for washing the sheep's skins as they come from the butchers.

7519. Is there any waste refuse from the washing process ?—There is nothing appreciable from that process.

7520. Is the water in a condition to make it available for washing, is it clean enough ?—We have to select it when it is least foul, it is excessively foul, but it answers our purpose.

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7521. It answers your purpose at present?—Yes.

7522. Can you imagine a time to come when it will not answer?—If it goes on deteriorating as it has done in the last 15 years I apprehend that it will hardly be fit for the purpose.

7523. What causes that deterioration?—There is a large amount of refuse sent in from other manufactories above us, both from tanneries and from woollen manufactories.

7524. Which are the worst, the tanneries or the woollen manufactories?—It is a choice of difficulties, the one discolours the water very much. I should almost think that the dyeworks are the worst.

7525. Do you discharge your water after you have done with it directly into the beck or into the sewers?—When our works were established there was no sewer up to our works, and all the refuse went into the beck.

7526. Does it continue to go into the beck?—Yes.

7527. Could you put it into the sewer if you thought proper now?—The sewer is near, and I believe that it is low enough to take our water, but the objection would be that if we took the water out of the beck and did not return it the millowners below us would complain of the loss.

7528. Do you take any of the town's water?—Yes, when we are short of water. We have a supply of spring water which we impound, and that in wet seasons will last us for a short time, so that then we do not require to pump. At other times we pump what we require. Occasionally the supply runs short although our bore-holes are 100 yards deep, and then we are driven on to the town's water.

7529. What number of skins a week do you get?—We generally get between 8,000 and 9,000 a week.

7530. And you convert them all into this material?—Yes.

7531. When these skins are manufactured where are they principally used?—In England and America and the continent.

7532. Do you send out any to the East, to Constantinople?—No; we have no direct connexions there. We sometimes send to the East Indies.

7533. What number of tanneries are there upon Sheepscar beck?—There are nine on the beck which manufacture skins of different kinds, including ourselves.

7534. Do they produce these leathers or another kind of leather?—Two manufacturers are the same as ourselves, the rest are mainly in the heavy trade.

7535. Are any of these split skins?—Yes, they are nearly all split skins.

7536. Then from a skin you get two substances?—Yes, one makes what is called wash-leather.

7537. Is this graining produced by machinery?—That is done by an electroplate. Those are all artificial grains. The one which you have in your hand is an imitation of pigskin which could not be detected under a microscope.

7538. Do you make an imitation of Russian leather?—No.

7539. Are these leathers used for bookbinding?—Yes, principally for what they call case-making, and portfolios, and that kind of thing. We also manufacture calf-skins which are largely used for ladies' boots.

7540. Does the patent leather cloth manufacture which has sprung up so largely in recent times come injuriously into competition with you?—It is used as a substitute for our leather to a large extent, but the demand is so great that if something had not been found as a substitute we could not have supplied the demand. What we used to pay 7*d.* for some years ago is now worth 27*d.*

7541. You know, with regard to the wool trade of Yorkshire, that cloth is never worn out now, it comes back in the shape of shoddy and mungo?—Yes.

7542. Does this material of yours return in any fresh state of existence after it has been worn out in the condition in which it is here?—There have been inventions for grinding and dissolving it and endeavouring to treat it in that way, but I have not yet heard of any practical success from the experiments.

7543. There have been attempts to utilize it after it has been considered worn out?—Yes.

7544. How many tan-pits are there upon your premises?—About 130 of different kinds.

7545. Do you use lime?—The skins have to be steeped in lime and water in the first process.

7546. Do you use any acids?—We use some in our glue manufacture, and also a little in what is called oil-leather and wash-leather manufacture, in recovering the cod oil used, which then becomes the article known as "sod oil."

7547. Is there anything in your waste water which you could extract which might be beneficial in the same way as the grease of the oil-water which we have heard spoken of?—We get out everything which we can, and anything which is valuable we sell as manure; we have a person who buys our waste liquid from the glue works, a neighbouring farmer, and he pays a small sum yearly for it.

7548. Therefore it does not go into the beck?—It does not.

7549. What becomes of the refuse from your work-people; have you privies or waterclosets, or what conveniences have you for them?—We have both privies and waterclosets.

7550. Are the privies emptied by yourselves?—The farmers in the neighbourhood come and take the soil.

7551. Do the waterclosets pass into the sewers or into the beck?—Into the beck.

7552. Would there be any difficulty in your keeping the refuse from the waterclosets out of the beck?—No.

7553. Then you would not consider it a very great hardship if you were restricted from passing the refuse from the waterclosets into the beck?—No. The only difficulty would be from being debarred the free use of the water coming down the Sheepscar beck.

7554. You would not like to be deprived of the use of the water by persons above you turning it away because it was somewhat tainted, and you feel yourself obliged to return the water from your own works into the beck with any pollution which you may have put into it?—Yes.

7555. Therefore if any means of purification is to be adopted it must be something which is general, both above you and below you?—I suppose so. I do not see how we can purify our own water so as to make it anything like pure like what we see on the table.

7556. What material do you use for obtaining the colours we see here?—The usual dyeing material.

7557. Do you use much indigo?—Yes, a considerable quantity.

7558. Is any of that material passed into the beck?—Not that we know. We work the vats, and get out all the colouring matter as far as we possibly can.

7559. You keep strengthening the indigo vats and do not draw them off I suppose?—We draw them off very seldom, only when they are quite spent.

7560. (*Mr. Harrison.*) How long is that sometimes?—Sometimes two months or more.

7561. (*Chairman.*) But when you do draw them off I presume that the water goes into the beck?—It does.

7562. I presume that at that time it will be deeply coloured?—There will be some colouring, but not very much blue colouring matter in it.

7563. Do you think that it would be a hardship for you to extract that colouring matter, if it could be shown that you could do it very cheaply, for a few pounds a year?—I do not think that the quantity of blue which we make is very material. Our waste liquid which we turn into the stream is mainly from the lime pits which have been used, and from the spent bark pits, and the other liquors which are produced in the different manufactures, and I can see no practicable way of purifying them. They might possibly be turned into the drains, but I do not see how they could be purified.

7564. You have not attempted in any way to purify them?—No.

7565. You have not at all given your attention to it?—No.

7566. Do you know the process of paper making?—Yes, a little.

7567. There is a process by which paper makers can purify their waste water. Do you sell the refuse lime as manure; is it carted away with the other refuse, or does a portion of it go into the beck?—What is held in mechanical combination goes into the beck, and the refuse is sold as manure.

7568. (*Mr. Harrison.*) Could you by settling tanks increase the quantity of that portion which settles to the bottom and which you sell as manure?—It would be very difficult I think.

7569. Where is the water power for which you say you must return your water?—There are mills below us using the water.

7570. (*Chairman.*) For wheel power?—Yes, there are two water-wheels or more.

7571. (*Mr. Harrison.*) So that they would complain if you did not return the quantity of water?—Yes, that is the difficulty which I see. We have a washing place, and we take in the water and wash our skins and it goes out again. That is the main quantity of water. We find that the beck water is very material to us. We could not do without it.

7572. (*Chairman.*) You would otherwise have to get a volume of water somewhere else?—Yes.

7573. And that would be a question of cost?—Yes.

7574. You could not afford to give 6*d.* per 1,000 gallons of water?—Certainly not. We pump 48,000 gallons, and in some seasons we use a great deal more than that in the washing process. We do not very accurately measure what we use. We have a washing trough. Sometimes I should think we use 200,000 gallons a day.

7575. (*Mr. Harrison.*) Do you find that you have to lower your wells so as to maintain your supply of water?—Sometimes we have to clear out the borehole, and at some times we think that we have a greater amount than at others.

7576. (*Chairman.*) What depth is your hole?—300 feet.

7577. What depth are your pumps from the surface?—The working barrel of the pump is about 20 feet below the surface of the ground; it works in a vault.

7578. Then your suction pipe will perhaps go down 20 feet more?—Yes.

7579. Do you not think that you could get a very much larger supply of water if you put the working barrel of your pump at a lower depth?—Yes. We have considered that as a question of expense. So long as we can go on well and comfortably as we are, we continue so.

7580. Does the water rise from the 300 feet up to the surface, or nearly to the surface?—It rises I think to within 15 feet at times.

7581. Then the probability is that you might have double or three or four fold your water by putting your barrel lower down?—I think so.

7582. Is it a good quality of water?—Yes, a very good quality of water.

7583. Is it softer than the town's water or the beck water?—It is not so soft as the beck water, but it is softer than the river Aire.

7584. Is soft water an advantage to you?—Yes, a great advantage.

7585. In what way?—It makes the goods more mellow and richer, and more pliable and easier to work.

7586. Do you use any soap?—No.

7587. Do you use anything as a substitute, such as fuller's earth?—No; the skins have to go through a similar process to the treating of cloth with pigs' dung; they have to go through a mixture of dogs' dung. We find dogs' dung the best, just as pigs' dung is for cloth.

7588. How do you get the dogs' dung?—It is a trade in our neighbourhoods; we give from 9*d.* to 1*s.* a bucket for it; whole tribes of boys come with it every morning.

7589. (*Mr. Harrison.*) Are you aware that within the last year a person who keeps a number of dogs had an action brought against him in consequence of the nuisance caused by them?—I was not aware of that. We obtain the dogs' dung from kennels in the neighbourhood. I mean from Bramham Park and Badsworth, and different places in the neighbourhood.

7590. Is the demand for it very extensive?—It depends upon the quantity which we are manufacturing; we are sometimes short. I have known human excrement used in the place of it, but the objection to it is that it is so extremely offensive.

7591. Where are the skins which you use obtained?—Principally from our own neighbourhood.

7592. Are any sheepskins imported?—There are some which are imported in a tanned state, they come very much from Australia.

7593. Do you know the quantity imported?—The quantity of skins and hides of all kinds dressed upon the Sheepscar beck is about one-half of the whole which are dressed in the borough of Leeds; that fact is taken from statistics which we obtained during the cattle plague. About 1,300,000 are dressed upon the Sheepscar beck, and, as nearly as I can estimate, about 550,000 are foreign skins.

7594. What is the total importation of hides?—I am not prepared to say.

7595. You cannot state what proportion you use at Leeds, compared with the whole kingdom?—No. We here dress hides and skins of all kinds, about $2\frac{3}{4}$ millions every year.

7596. Has Sheepscar beck obtained its name from the preparing of sheepskins?—No.

7597. (*Professor Way.*) Has any effort been made to substitute anything else for dogs' dung?—We have tried ammonia, and salt, and soda, and some other things, but we have found nothing which will produce the same effect as dogs' dung so economically, or which is so well adapted for the purpose.

7598. Is it not the fact that dogs' dung consists almost entirely of bones highly divided and comminuted?—I had some dogs' dung analysed by a chemist of Leeds, and phosphate of lime seemed to be a large constituent of it.

7599. Was not there phosphate of lime in large quantity?—I have the analysis at my works.

7600. Have highly diluted ground bones ever been tried as a substitute for dogs' dung?—No; but perhaps the experiment is worth trying. The use of this material is a great nuisance.

7601. (*Mr. Harrison.*) I am to gather from your evidence that you would find greater difficulty in dealing with your tan refuse than Mr. Nickols and others would find in dealing with theirs. Their refuse might be sent into the sewer without any person complaining?—Yes.

7602. But if yours was to be turned on to the land, you would diminish the water power for the mills below?—Yes, I believe that the drain which has been made since we have been there is low enough to carry off the water from the pits. The pits are about five or six feet deep, and if the refuse had to run from the bottom of the pit into the drain, that drain must be very low. I am rather doubtful whether the drain is sufficiently low although we were told that it was.

7603. But supposing that it was sufficient, there would arise the difficulty of abstracting the water from the mill power?—Yes.

7604. (*Chairman.*) What kind of skins do you use for this process?—Sheepskins.

7605. Exclusively?—Yes, those samples are all sheepskins except one.

7606. Are kangaroo skins to any extent imported into this country?—Yes, we have had kangaroo skins.

7607. For what purpose do you import kangaroo skins?—They make very good leather for boots, but we have never had any except from curiosity. We have not had them as an article of commerce. They would be very valuable if they came in sufficient numbers, and at a reasonable price.

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7608. Do any alpaca skins come over to this country?—No, I never heard of any.

7609. Have you any sheepskins from the country where the alpaca wool comes from, or are the skins not sent because they would not bear the carriage, or what is the reason?—In many of these countries where the sheep are grown the atmosphere is so hot that between the time of the sheep being killed and the skin being dried, unless great care is used, the skin becomes putrid.

7610. Have you never had alpaca skins submitted to you to see what kind of leather they would produce?—No.

7611. Do you tan dog skins?—No. I have tanned one of my own, but not as an article of commerce.

7612. If dog skins were supplied in sufficient quantity would they serve a similar purpose to sheepskins?—No, they are not large enough.

7613. And the substance I suppose is not the same?—No, it is different altogether. They are useful for gloves.

7614. Do you know whether it is true that rat skins are very largely tanned and used for gloves?—I have heard of it but I do not know it.

7615. There is no such trade in England?—No.

7616. If there had been such a trade in England do dou think that you would have known of it in Leeds?—Yes.

7617. Do you tan pig skins at your premises?—No, the pigs in this part are not skinned. In Scotland they are skinned and the skins are chiefly tanned in Scotland.

7618. Pig skin is used for saddles?—Yes, and what I have produced is an imitation either for inferior saddles or for a part not requiring any great wear.

7619. (*Professor Way.*) This imitation of the pig skin is not so permanent as the pig skin itself?—No, it is about one third of the price. One of those skins is an imitation of goat skin. It is quite as beautiful, or more so, and it is one third of the price, but it will not wear so well.

7620. (*Chairman.*) Goat skin I suppose is morocco?—Yes.

7621. It is called morocco I suppose because it was first introduced from Morocco into this country?—Yes.

7622. Do you tan many goat skins?—We tan some, but our chief trade is in sheep skins. Goat skins are much more largely manufactured in Germany and France, and a few in London.

7623. Is anything done with hare and rabbit skins in the shape of tanning, or are they simply used as fur?—The fur is cut off the rabbit-skins by those who make it into hats. The skins are cut into shreds, and we buy the shreds to boil for glue. They are not tanned.

7624. What becomes of hare skins?—They are treated in the same way I believe. There is a great number of those small animals which produce fur whose skins are treated in the same way; they are cut into shreds.

7625. Did you ever tan chicken skins?—No.

7626. Did you ever hear of its being done?—No.

7627. (*Mr. Harrison.*) Is the Sheepscar beck a nuisance?—It has been complained of lower down the town and in consequence it is intended to improve the bed of it by our Improvement Bill. It becomes offensive in hot weather.

7628. (*Chairman.*) Is it not contemplated to arch it over?—That was under contemplation. We have taken power to do so, but it is not intended to carry it out.

7629. You have merely walled the side of it and formed an invert so as to take away the refuse more quickly?—Yes.

7630. (*Mr. Harrison.*) At the lower part of the town it might be carried through without any difficulty?—I think so.

7631. So that what Mr. Rawlinson mentioned just now of the plan of having the beck covered in its passage through the town and allowing the water to be used in different places might meet the difficulty, the water being eventually turned into the sewer and taken with the sewage on to the land?—I should suppose so.

7632. Do you see any other way of meeting the difficulty of that pollution?—No.

7633. (*Professor Way.*) You use the ordinary dyes such as are used in the woollen trade?—Yes.

7634. But many of these colours, I suppose, are got from variations in the quantity?—Some of them.

7635. How many different kinds of material are brought to bear in order to produce this result?—We use in our dyehouse a very large number, perhaps 150 different articles of all kinds. The principal are indigo and cochineal, and the dyewoods and the aniline colours.

7636. The variations of colour are got by different mixtures?—Yes, and by toning down with different things.

7637. (*Chairman.*) From what leather are gloves made?—Gloves are generally made from kid-skins—young goat skins.

7638. And from dogskins?—Yes.

7639. Is what you would call the best Paris kid or best Dent's kid really the skin of kid?—Yes, I should say so. It will be tanned and shaved down.

7640. Is that process carried on in Leeds?—No.

7641. Where is the seat of that trade?—At Paris, I should imagine, in France, and in Switzerland, and some in London and Worcester.

7642. Do you think that Dents get their skins from Paris?—I suppose so.

7643. Do you use engine power?—Yes.

7644. To what extent?—About 50-horse power.

7645. What weight of coal do you use per annum?—We use about 200 tons a month.

7646. What weight of refuse ashes have you?—We have a considerable quantity of ashes of course. Those we lead away to wherever we have an opportunity of placing them.

7647. If you have 200 tons a month of coal do you know what weight of ashes you have in a month?—No, I have never tested that.

7648. You do take the ashes away?—Yes.

7649. At a cost to yourselves?—Yes.

7650. Do you remember about what the cost is?—It is just the leading away, it will not be a very great deal, it depends upon where we can find a place to put them.

7651. You do not put any of them into the beck?—No.

7652. Therefore, in order to carry on your trade, you have to incur the expense of carrying away your ashes?—Yes, together with our spent bark. The spent bark is not of any value, and we have to deal with it in the same way.

7653. Have you never tried to burn it under the boiler?—Yes, and it burnt the bottom of the boiler out. In the first place, the spent bark is generally damp, we cannot afford the time to dry it, a few shovel-fulls damps the fire, and afterwards burns up very strongly, and that makes the heat intense, and the expansion and contraction wear out the joints.

7654. Therefore you have ceased to burn the spent bark on that account?—Yes. We had a press on purpose to squeeze all the liquid out of the bark and to make it nearly dry, and we used it in that state, but the effect was so injurious that we abandoned the practice.

7655. To what was it injurious?—To the boilers, in the way of which I speak. The burning under the boilers injured the plates.

7656. Then it was too good for its purpose?—It was not dry enough.

7657. (*Professor Way.*) I suppose that a certain part of the absolute fuel of the coal was taken in drying the spent bark?—We found no saving in using our spent bark.

7658. What kind of press was it which you employed; was it a continuous press?—It was a press made for the purpose.

7659. Have you heard that the brewers have endeavoured to burn their spent hops in the same way?—No.

7660. I have seen it done, and have also been informed that instead of a saving it is an expense, still they have to get rid of them?—Just so. The saving at which we were aiming was as regards leading the refuse away. We at one time burnt the bark in a heap and then the neighbours complained of the nuisance and of the smell.

7661. (*Mr. Harrison.*) If you follow up the Sheepscar beck where do you get anything like pure water?—At Addle we get pure water above the manufactories. There is the Addle reservoir.

7662. Does that belong to the corporation;—No, it belongs to the mills on the stream.

7663. It is a compensation reservoir?—Yes.

7664. Was it erected by the millers in conjunction?—I suppose so, it was before my time. There are manufacturers on the beck almost to the extent of the boundary.

The witness withdrew.

Mr. JOHN MITCHELL (Leeds) examined.

Mr. J. Mitchell.

7665. (*Mr. Harrison.*) You are a member of the College of Veterinary Surgeons?—I am.

7666. And you are engaged as a veterinary surgeon in this neighbourhood?—Yes.

7667. How long have you been so engaged?—20 years.

7668. In the neighbourhood of Leeds?—Yes, I have been all my life in the neighbourhood.

7669. Do you know the outlet of the Leeds sewer?—Very well indeed.

7670. Have you as a veterinary surgeon observed any ill effects from the sewage being passed into the river at that point?—I was cattle inspector for that district, and my duties led me down there every day during the latter end of last summer, and the river during that time was in a most abominable condition.

7671. It was a dry summer?—Yes, and very little water got into the river, and it was studded from one end to the other with fæcal matter floating at the top; in fact, I cannot make use of sufficiently strong language to describe the state of the river.

7672. Was the smell very bad?—Awful; there was a continual exhalation of gas, and the river was in a complete state of ferment. Sulphuretted and carburetted hydrogen were given off in large quantities.

7673. Did you see large masses of matter raised up?—Yes, I have seen fæcal matter floating on the top of the river, the result of a fresh fermentation, and I have also observed very large quantities thrown up on account of the gas being disengaged.

7674. Do you know whether the cattle in the fields adjoining the river drank of the water of the river?—They did not drink of it of necessity, but they did drink of it.

7675. Did you observe any ill effects from their drinking it?—It no doubt predisposed them to disease. Thorpe Hall was the first place in Yorkshire where the cattle plague existed.

7676. Could you trace the cause of the introduction of the cattle plague into that neighbourhood in any way?—It was traced to the introduction of a foreign bullock into the pastures.

7677. Where was it imported from?—It was brought to Leeds market, and thence to the Thorpe Hall pastures.

7678. Where was it landed?—I do not know. I believe that it was one of a cargo which was sent over to Hull and went to London.

7679. Do you think that the disease itself was introduced by that animal?—Most decidedly.

7680. Am I to learn that you think that the cattle which were grazing in the meadows were predisposed to disease in consequence of having drank the water of the Aire?—Yes, and from having inhaled the vapour.

7681. And from the condition of the atmosphere?—Decidedly.

7682. Was the result very marked?—It was very bad indeed.

7683. Are those meadows common meadows?—Yes, they are meadows upon which any person can turn in cattle by paying for them.

7684. What number of cattle might there be upon those marshes?—Last year there were perhaps nearly 200.

7685. After the disease was introduced was an order issued for the non-removal of the cattle?—Some little time afterwards; but in the meantime a great portion of them were removed after the first case of cattle plague had made its appearance.

7686. Before the cattle were prevented from being removed, could you trace the disease as being carried by those which had been removed to other parts of the country?—I only traced one case. From a distance of 20 or 30 miles people bring their cattle to those pastures; they bring them from Huddersfield and round Bradford.

7687. You presume that as soon as they found the cattle plague there they removed them off as soon as they could?—Yes.

7688. What number were left when the Order in Council was issued?—About 100.

7689. What proportion of them were carried off?—I think that nearly 70 died, and besides these some were slaughtered, being supposed to be diseased.

7690. Were any taken away from the meadows subsequently to the Order in Council for their non-removal?—Yes.

7691. Was it your duty as inspector to prevent that?—I summoned a person before the magistrates.

7692. What was the result?—There was a penalty. He took 20 away from the pastures to Swillington, in the immediate neighbourhood, and he lost 14 of them.

7693. Other cattle took the disease from those which had been taken from these meadows?—No cattle in the neighbourhood took it except the 20 which that person took away, none but his own cattle took it.

7694. Had you no case where cattle in the neighbourhood took it from those which were removed?—I had a case within three-quarters of a mile, but we could not trace any contact at all. I had only two infected farms in the village.

7695. You say that you have lived in this neighbourhood all your life, do you observe much alteration in the condition of the river?—Yes, both above and below Leeds.

7696. Do you find it in any way the cause of ill-health to stock on the banks of the river?—I do not know any cattle which graze on the banks, excepting those at Thorpe Hall, and there there is generally a disease of some sort. A few years ago a very large number both of horses and cattle died from what is called splenic apoplexy.

7697. What number of cattle died altogether in this neighbourhood from the cattle plague?—I had nothing to do with the borough; my division was the Skyrack division of the West Riding.

7698. In that division how many died under your inspection?—About 150, as nearly as I can guess.

7699. Do you believe that there is any remedy for the disease?—No.

7700. Do you think that the means which were taken were the proper steps for staying the plague?—Decidedly; slaughtering the beast and stamping the disease out.

7701. Did you slaughter to any great extent?—Only five.

7702. Was that strictly in accordance with the order and the Act of Parliament?—Yes. I have slaughtered since the compensation. I slaughtered

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five before there was any compensation to owners, but after the compensation clause I have perhaps slaughtered a dozen.

7703. Not more than a dozen?—Not more than a dozen. The disease has been dying out; we have had none since last April.

7704. Is there anything else which you wish to state?—I may observe that the water of the Aire has to flow over a dam stone about two-thirds of the length of the pasture from the outlet, and the stench there is abominable, it is fit to knock anyone down; the water runs several feet over a dam stone, and the smell is awful.

7705. Is that generally the case, or do you allude to any particular time?—Only in very dry weather.

7706. How far could you perceive that smell from this dam stone?—Several hundred yards.

7707. Have you known any ill-health occasioned to individuals by it?—Yes.

7708. How did that come under your notice?—By a gentleman telling me himself. I believe that he was obliged to remove from the neighbourhood. Mr. Fenton, who lived at a house at Thorpe Stapleton, told me that he dared not open his windows.

7709. Was that the farmhouse which was mentioned yesterday?—No, it was a house which he built some little time ago at Thorpe Stapleton.

7710. (*Professor Way.*) You mentioned that you were of opinion that the smells arising from the river and the drain predisposed the cattle to disease?—No doubt of it.

7711. Did you observe any effect in intensifying the disease when they were attacked, was the attack more rampant?—Decidedly.

7712. May we take it that the cattle plague is a kind of typhus, at least is that the effect?—That is the effect.

7713. And does decomposition rapidly set in even during life?—It does.

7714. Is it the case that putrid emanations of different kinds will cause a very rapid destruction of meat or animal matter?—Decidedly.

7715. Then you think that the cases were less likely to be met by treatment where such a cause as this discharge of sewage existed than otherwise?—Decidedly.

7716. In your opinion is the cattle plague remediable?—I think not; I never yet attempted to cure a case.

7717. Therefore the slaughtering of the animals can hardly be said to have destroyed the chance of saving their lives, for they would have died under any circumstances?—Just so; almost every animal had medicine given to it by the owner.

7718. (*Chairman.*) Did it come within your knowledge that any of the meat was consumed for human food?—A great deal of it.

7719. What were the effects?—There were no bad effects that I know of; I have eaten of it myself.

7720. Did you try any experiments with dogs?—No; I know that experiments have been tried at the college. I saw the dogs and the cats as well.

7721. I suppose that it is a fact that besides dogs there are birds and animals which have the power of assimilating putrid meat?—Yes.

7722. To almost any extent?—To any extent.

7723. Have you ever known dogs injured by eating putrid meat?—I have known them break out with mange and other cutaneous diseases.

7724. Do you think that that is from being kept on carrion?—Yes.

7725. In hunting kennels what sort of meat is usually given to the dogs?—Horseflesh, and boiled oatmeal or Indian meal is mixed with it.

7726. What would be the effect of feeding fox-hounds upon tainted meat?—They no doubt would suffer in their health.

7727. Are they also obliged to be careful in cleansing the kennels?—Very.

7728. (*Professor Way.*) Is dog's meat given uncooked?—No, it is all cooked.

7729. Would it be injurious if it was given uncooked?—Decidedly.

7730. Do you know whether in the case which you speak of at Thorpe Stapleton there was any difficulty in keeping cooked or uncooked provisions?—I never heard that. I know that the owner of the house was very fond of high-kept provisions—grouse, and things of that sort. He used to send to Leeds for grouse which I think would scarcely bear the carriage home.

7731. I suppose that you know that an impure atmosphere is not suited for the preservation of meat in a fresh state?—Certainly not.

7732. Was there any indication of that?—I never heard of it.

The witness withdrew.

S. Smith, Esq.

SAMUEL SMITH, Esq. (Leeds), examined.

7733. (*Chairman.*) Are you a doctor of medicine?—No; I am a Fellow of the College of Surgeons.

7734. How long have you resided in Leeds?—Seventy-six years.

7735. How long have you known the river and the becks flowing into the river at Leeds?—Since I was 10 years of age.

7736. In what condition were they when you first knew them?—They were very clear streams, and there was very excellent fishing even in what is now the centre of the town.

7737. You remember catching fish in the becks where the centre of the town now is?—Yes; my principal fishing place was upon an island called School Close, which at that time consisted of green fields and hedges with tenters, and scarcely an inhabitant in it; but Mr. Fowler will tell you that it is now full of streets and houses, warehouses and mills, and is a very populous district. That was my first fishing ground.

7738. Can you state anything to the Commissioners relative to the health of the inhabitants of Leeds as coming to your knowledge as consulting surgeon to the infirmary?—Yes; but I cannot state much, as I was the surgeon of the infirmary and not the physician—the surgical cases only came under my observation.

7739. With regard to the surgical operations, have you found any difficulty in treating them in the wards of your hospitals in Leeds?—Yes; we have had occasionally erysipelas and hospital gangrene prevail.

7740. That I suppose indicates a bad atmosphere?—Yes.

7741. I understand that a new infirmary is being erected now?—Yes.

7742. Larger, and of a superior class?—Yes, and with every appliance to prevent these diseases.

7743. That I suppose will confer a great benefit upon the inhabitants?—We have no doubt it will.

7744. When will that infirmary be opened?—It would have been opened next summer; but, as they will have a great exhibition there in the spring of 1868, it will probably not be opened till the winter of that year—perhaps not till the following spring.

7745. Is the exhibition to be in aid of the funds for furnishing the institution?—Yes.

7746. What state do you find the rivers and becks in now?—Horrible.

7747. Very foul?—At the request of the town clerk a few months ago I examined what is called the Sheepscar beck, from Timber bridge at the bottom of Kirkgate, to the Tobacco mill at Sheepscar, and I found it in a most horrible state; there were dead cats and dogs and filth of every description that you can imagine, and the water was actually black.

7748. Do you think that that is a state of things that ought to continue to exist?—No.

7749. If it can be remedied it ought to be?—Certainly.

7750. Have you ever been a member of the town council of Leeds?—No.

7751. You have noticed, I daresay, that they have carried out a system of sewerage?—Yes.

7752. Do you know whether there is as much fever now as when you first knew Leeds, in proportion to the population?—I should think we have more; for the few years immediately following the completion of the sewerage we had considerably less fever than we had had for many years; but we have had rather an accession of fever during the past year.

7753. In what portions of the town does the greatest amount of fever prevail—in the lower districts?—I have not had much practice amongst that sort of people; but I think it prevails a little more in the east, towards the bank and along Sheepscar beck.

7754. Is there anything further that you wish to add?—Only thatI have had experience of the fishing in the river Aire and in the Calder 60 years ago, when a good basket of fish could be taken; but no such thing can be done now, that has been gone for 30 years.

7755. You do not think that it will come back unless something were to result from this Commission to bring about the purification of the water?—I have no doubt that good can be done. I know a gentleman who saw two salmon rise at once below the bridge at Harewood, but that has not been seen for 40 or 50 years.

7756. Was that in consequence of any improvements which had taken place?—I think it was in consequence of an alteration of the dams and the salmon ladders. I may state that about 50 years ago I attended a person of the name of Nelson, who lived at Beeston Lodge—I think he died when he was about 80—and he said that when he was a young man he once speared a salmon weighing above 20 lbs. in School Close, in Mr. Lawson's gardens; that was about 110 years ago, in the island I have been speaking of, that which is now the centre of Leeds.

7757. (*Mr. Harrison.*) What kind of fish did you catch in your time?—In the neighbourhood of the town nothing but scale fish; but two or three miles up I occasionally got a trout; four miles down, the river abounded in both trout and grayling; opposite Temple Newsome I have often killed a nice basket of fish, 60 years ago, with a fly.

7758. (*Professor Way.*) I suppose you look upon the question of the fish rather as an indication of the impurity or purity of the water than as being of material importance to the welfare of the district?—Yes.

7759. May we also take it that you consider such a condition of the river as at present obtains in the Aire and its tributaries is prejudicial to the health and comfort of the people of the district?—Certainly.

7760. And ought to be remedied if possible?—Yes.

7761. You do not hold out any great advantage in the fish coming back, even if they could?—I do not know; I think that many labouring men, at times when they were slack of work, used to go and make a very good day's wages by catching fish and selling them at 4*d.* or 6*d.* a pound. I have know many instances of that kind, of men who always took to it when they were out of work.

7762. Suppose the river could be so purified as to make it habitable by fish, if it cost each manufacturer 50*l.* or 100*l.* a year it would be rather a dear dish of fish?—Yes, certainly.

7763. Something short of that would be still a great advantage to the district?—Yes. There are places in which large quantities of fish were to be found 50 and 60 years ago, but now a fish is scarcely ever seen. A few months ago I went to see the wife of the tenant of Fleet mills. I walked with him to the Woodlesford Station mill and I was astonished to see the filth and the blackness of the river, and he said that when he was first a tenant his men would sometimes kill 14 stone of scale fish with a net in an evening, but latterly there is scarcely ever a fish seen.

7764. Were they valuable fish?—No, but they would sell for 4*d.* a pound. I mean dace and chub, fish with scales. I was once attending a patient at Newton, two miles beyond Castleford. I baited my horse at Castleford on the road home, and I fished for an hour or so, and once killed 27 lbs. weight of scale fish in three hours with the fly, from 9 to 12 at noon; but I think if I were to go now and fish for 20 days I probably could not kill 2 lbs. That was about 40 years ago.

7765. (*Mr. Harrison.*) In a town like Leeds where there is a dense population adjoining the river, and where the labourers cannot without a considerable walk get out into the country, if the river would afford them that amusement, would it not be a source of great enjoyment and health to them?—Certainly, even if they caught nothing.

7766. They could not get fresh air without a long walk?—No, and they would catch very little fish nowadays.

The witness withdrew.

Mr. Charles Smith (Leeds) examined. *Mr. C. Smith.*

7767. (*Chairman.*) Are you manager of the old gasworks of Leeds?—I am engineer.

7768. What was the date of the formation of those works?—They were incorporated in 1818.

7769. What number of retorts have you in use now?—440.

7770. What weight of coal do you use in a year?—About 38,000 tons.

7771. Do you use cannel coal?—Mixed coal. We manufacture about 310,000,000 cubic feet per annum.

7772. What do you purify with?—Oxide of iron and dry lime.

7773. In what proportion do you use those purifiers?—We use the oxide of iron to take out the ammonia, and the lime to take out the sulphur.

7774. You use them jointly?—Yes.

7775. What weight of lime do you use in a year?—I think nearly 2,000 tons.

7776. What becomes of that when you have used it?—It is sold to the farmers as manure at 6*d.* a load.

7777. Have you any difficulty in selling it?—Just now we have a stock on hand, but it is the first we have had for some time.

7778. How many tons have you now?—500.

7779. Has that lime any special name?—It is commonly called gas lime.

7780. You do not use wet lime, do you?—No.

7781. What amount of coke do you make per annum?—We make about 12 cwt. per ton of coal on the average.

7782. Of course you have no difficulty in getting rid of the coke?—We sell it.

7783. Do you use it on your own premises for heating the retorts?—Yes.

7784. You do not necessarily make smoke?—No, no smoke.

7785. Except in the first charging of the retort?—That is all collected. We do not allow that to escape.

7786. (*Professor Way.*) In drawing the retorts is there no smoke?—Yes, a little; when the hot coke falls upon a little tar that causes smoke, but it all goes up the works.

7787. Does not it go outside?—It goes out through the ventilators certainly.

7788. Is any refuse at all passed into the streams from your works?—None at all, except when we are compelled to empty a large gasholder tank, which is very rare. I have been there 34 years and there have been only three emptied during that time, and they were emptied for the purpose of making repairs.

7789. You can carry on gas making without injuriously affecting the stream?—Yes.

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7790. If necessary I suppose you could do something to get rid of that water?—I do not know. That would be a difficult matter. Where should we put it?

7791. What volume is it?—About 1,250,000 gallons in our present gasholders, that is, in the tanks.

7792. Of what diameter are they?—102 feet. We have one 120 feet. We are just filling two of 102 feet each, and they will take about 2,500,000 gallons.

7793. Does the gas take up any vapour so as to reduce it, or are you obliged to keep supplying the tank?—No; what we call a good tank of rain will supply all the evaporation, that is, the rain that falls on the holder.

7794. (*Professor Way.*) Is there any condensation in those holders that would make material worth extracting, is there any ammonia in the water after it has been used?—Yes; it will be slightly tainted with ammonia in the working.

7795. Is that worth extracting?—No; we have gasholders which have been in use since 1824, and the same water is still in.

7796. When you are bound to change the water, has it ever been suggested that there might be in that water material worth extracting?—Not to pay the expense.

7797. (*Chairman.*) With regard to the condensed water in your receptacles on the mains, what do you do with it?—That is carted back to the works and put into tar cellars.

7798. It is not thrown into the sewers?—No; it would cause us great trouble if we did that; parties would complain of the escaped gas, and we should then have to send a man to ascertain the cause, and we should find it a great cost to do that; we find it advantageous to cart the syphon drippings into wells.

7799. You use your coke or sell it, and all the gas tar and ammoniacal liquor, and all the refuse lime?—Yes.

7800. Does the oxide of iron ever become exhausted?—It is furnished to us and brought on to the premises, and we receive a certain price per ton for saturating it with ammonia, and the parties take it back again and extract the ammonia from it.

7801. And bring back the iron again?—Yes.

7802. That I suppose would not sufficiently purify the gas without the aid of lime?—It would not.

7803. Would there be any hardship in taking away that lime daily as it is produced, instead of storing it?—I think there would be a hardship. I think we should not be able to get rid of it daily; in some parts of the season the carts are waiting for it for two or three hours; but it depends upon how the farmers are situated.

7804. Have you ever used any of it to grind up into mortar?—Yes.

7805. With what effect?—It does not answer for that purpose. If a wall was built with it, and damp weather was to come on, every joint of the bricks or stone would show through the plaster.

7806. For the foundations of bridges and other purposes below the ground, and for heavy work of that kind, for the foundations of large warehouses, for instance, it makes good binding mortar, does it not?—I have never seen it used for that purpose.

7807. (*Mr. Harrison.*) Where are your gasworks situated?—One is in the east end of the town, and the other over the river, at New Wortley.

7808. Mr. Tennant in his evidence to-day stated that a few years ago he had been annoyed by gas refuse passing down the river. Would that have been from your works?—No.

7809. (*Chairman.*) You use cast-iron for your street mains and wrought-iron for your services, do you not?—Yes, for the smaller ones.

7810. What size is your largest wrought-iron service?—One inch; we go to cast-iron after that.

7811. What endurance do you get out of wrought-iron?—It greatly depends upon the place where it is laid. I know branches in soil or clay that are perfectly sound to this day, though they have been laid 20 years; but if laid in ashes from chemical works they will not last 20 months.

7812. It depends upon the material in which they are laid?—Yes.

7813. Do you use for the inner parts of houses block tin, or a mixture of tin and lead?—A composition.

7814. Do you use that because it bends about with facility?—No, not exactly for that reason, but because no corrosion will form inside it, as in iron; if there is a little moisture it will not corrode or rust, like iron tubing.

7815. Would there be any difficulty in supplying an entire building like this with wrought-iron tubing instead of the other?—No.

7816. In putting your wrought-iron tubing together, your men manage to make their couplings or joints so that they can take them to pieces at particular parts without breaking down a great length?—That is the general practice of gasfitters.

7817. There is no difficulty in carrying wrought-iron mains anywhere and in any direction with bends and couplings made by the fitters?—There is not the slightest difficulty.

7818. If you were told that they are not used for waterwork purposes because they are so much more difficult to handle, I suppose you would not believe that?—No.

7819. Have wrought-iron fittings been used for water supply purposes?—I have not seen them used for generally supplying water.

7820. Do you take any special precautions when you have to lay your wrought-iron tubing amongst ashes or old building material?—No, that work is generally entrusted to labouring men; we do not see every yard of ground; we generally give the wrought-iron tubing a coating of boiled tar, having heated it first.

7821. Do you use any galvanized tubing?—No.

7822. Do you believe that to be beneficial?—No. I have seen galvanized tubing, and a person told me it would stand anything. I mentioned the subject of ashes to him, and he said, Now these tubes will stand anything. I said, I will put a few bundles up here, and told him to call again in three months. I put them on the top of the purifying house, and when he came again I found them to be as rusty and worse than the others.

7823. (*Professor Way.*) That was in a gas-house?—Yes; part of the ammonia was flying about.

7824. I suppose you know that of all things to rust iron ammonia is the worst?—Yes.

7825. (*Chairman.*) Have you had applications made to you by parents to bring their children into the purifying houses when suffering from whooping cough and croup?—Daily.

7826. Do you admit them?—Yes, as many as come; we sometimes have a score at once there.

7827. Do you think that any beneficial results are worked by it?—I do not know. I have never seen anything particular. I am told it does so. Mothers believe in it, and they bring them there daily. A person told me no later than last week that he had one child that had been perfectly cured.

7828. I suppose you would infer that if the purifying house is so beneficial for this class of disease, it cannot be very injurious in other cases?—I think not. We consider our purifiers to be as healthy a set of men as we know.

7829. If they could be restrained in their drinking habits you think they might enjoy as good health as any persons?—Yes, I think so.

7830. You do not believe that there is anything injurious in the smell of gas?—I do not.

7831. Do you live upon the premises?—Yes, I did for many years; I do not now.

7832. You have your offices there?—Yes. I have a daughter on the premises who is married, and if I thought it was injurious she should not live there.

7833. (*Professor Way.*) How often is the lime changed?—Six times in 24 hours at present on each work.

7834. In each purifier?—No; we have six changes a day; we change six purifying boxes each day at each of the works.

7835. Out of eight?—Out of 24 boxes.

7836. How much lime would they represent?—Perhaps about a ton and a half each box.

7837. Nine tons a day?—Yes, at this time of the year.

7838. It would accumulate I suppose very fast if you did not dispose of it?—Yes, it would at this time of the year.

7839. The chairman asked you whether you could not cart it away day by day. I suppose six or eight cartloads are a fair quantity to get rid of?—Yes, and there is more than that.

7840. Is there any difficulty in carting it away?—We should have to pay an additional cost; we can now sell it at a small price; if we were obliged to take it away we should have to pay a little more to have it removed.

7841. (*Chairman.*) What dividend do you pay?—Six per cent.

7842. (*Professor Way.*) Do the farmers always cart it away when they can spare their carts and horses?—Yes.

7843. Do you ever hear complaints made that when used for agriculture it injures the crops?—No.

7844. Do they expose it for some time before they put it on to the land?—They use it in different forms; sometimes they put it on with stubble and floss on grass land; at other times they mix it up with road scrapings and so put it on.

7845. As a rule they prefer to let it stand in the air and get stale before they use it?—Some do. If I wanted a load I should want it fresh; if a garden is infested with vermin, slugs, and snails, fresh lime is considered the most powerful agent for destroying them.

7846. If there is any objection made by the farmers that it has injured the land, you would say it is from the want of proper use?—I heard one say the other day that it made the sweetest grass land of any manure, but cattle will not go near to it when it is newly laid on.

7847. You stated that you could not take sulphur out of gas without lime?—It could be taken out, but I think it would be at a great cost.

7848. Is it the fact that lime is not used at all in some of the gasworks?—I do not know any works where lime is not used; where the oxide is used I believe they use a little lime.

7849. Would not iron of itself absorb sulphur?—Yes, it would, but not to that extent that we should require, not perfectly clean.

7850. Have you ever sold any of that material direct for agricultural use, I mean the oxide of iron?—No.

7851. Do you know that it is put into manures?—Yes.

7852. Do you know also that it has produced great mischief sometimes from being put improperly into manures?—Yes.

7853. You contract for the supply of the material, and you do not know what becomes of it?—No, we do not.

7854. Are not the materials that you produce too valuable to be wasted and thrown away?—Yes.

7855. The least valuable is the lime?—Yes.

7856. The others are the tar and the ammoniacal liquid, and the oxide of iron when it is saturated?—Yes.

7857. They are far too valuable to be thrown into the river?—Yes.

7858. What does the tar fetch now?—About 20*s.* a ton, 220 gallons to a ton; we retail it out at 2*d.* a gallon.

7859. It is used for making the aniline colours?—Yes.

7860. There is no likelihood that the demand for it will diminish, is there?—No, I am not aware that it will; it is more sought after in London than down here.

7861. If it can be proved that some years ago the makers of gas were polluters of the rivers, you would not admit that they are so now, or that they are likely to become so in future?—Our refuse is too valuable to go into the river.

7862. Is it not possible that some of the refuse which now injures the river may, if it is obliged to be kept out, be found too valuable to be thrown in for the future?—Yes.

7863. In the first instance you kept the refuse of the gasworks out of the river, not to make a profit of it, but because you were obliged?—Yes.

7864. And when it was kept out a use was found for it?—Yes.

7865. (*Chairman.*) I suppose that there is not an ounce of material that you do not utilize in one way or the other?—No, I think not.

7866. Excepting the water in the gasholders?—Yes.

7867. If you had no repairs to make it never need be changed?—No.

7868. What do you do with the ashes that you make on the works?—They are carted away.

7869. How many tons do you make in a year?—This time of the year we shall make 20 tons in a day at the two works.

7870. From the retort furnaces?—Yes.

7871. You cannot utilize the ashes?—No, they are carted away, we pay 6*d.* a load to have them carted away; they go anywhere; thousands of tons go down the railway for ballast for the line.

7872. What do you get a ton for the coke?—About 7*s.* 6*d.*

7873. What is it used for?—For various purposes; amongst others, domestic purposes; we have sold as many as 42 tons in half cwt. bags in one day for cottage property occupied by Irish.

7874. Do they use it in chafing dishes in their rooms?—No; it is used in a common grate.

7875. Is it cheaper to them than coal?—Decidedly, it will burn longer.

7876. Is it used for locomotive purposes?—No, it is not strong enough.

The witness withdrew.

Mr. William Hirst (Leeds) examined.

7877. (*Chairman.*) You are secretary of the Chamber of Commerce of Leeds?—Yes.

7878. Have you resided long in Leeds?—For five years.

7879. I suppose the members of your Chamber of Commerce are in communication with each other throughout the manufacturing districts?—Yes.

7880. The object of the Chamber of Commerce is to give information to each district as to the raw material and the manufactured goods, is it not?—No, we do not interfere at all with that; it is to look after the general interests of trade, such as the law affecting trade, banks, and foreign tariffs and regulations abroad as to trade, and anything of that kind, and also the trade of the town generally.

7881. As to the pollution of rivers, does that come within the scope of the operations of the Chamber of Commerce?—No; it would be our duty undoubtedly to defend our manufacturers from any annoyance on account of the state of the rivers.

7882. If it is the duty of the Chamber of Commerce to defend the manufacturers from annoyance, it would

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be the duty of the Chamber of Commerce, I presume, to facilitate anything that would increase the productive power in manufactories?—Decidedly so.

7883. Do you know the condition of the rivers and streams throughout Yorkshire and Lancashire?—I have a pretty good idea of them in both counties.

7884. What condition are they in for trade purposes?—They are certainly getting into a bad condition, especially lower down the streams; the Irwell at Manchester is in a very bad condition. Manchester is the extreme point of trade down the valley. It is the same with the Mersey at Stockport—that is in a bad condition; and in Yorkshire the Aire and Calder are also in a bad condition; but I think they are scarcely so bad as has been represented—the water is very dirty, but still you find that dyers find it is not unuseable; they find that it still can be used for washing clothes and rags; it is bad, but not so bad as has been represented.

7885. Surely the dyers themselves would be the best judges as to the quality of the water?—Decidedly it is bad, but I am speaking of degree.

7886. Is the obstruction of watercourses by the passing in of solids, such as furnace ashes, and solids of other kinds, not liable to injure trade by filling up the beds of rivers?—By polluting the water it does, undoubtedly; but filling up the bed of the river does not I think affect manufacturers, but merely the district. Mill power may be affected to some extent, but mill power by water is very limited in comparison with the steam power that is used.

7887. A manufacturer has stated that the floor of his mill was liable to be flooded seriously so as to injure the carrying on of his business, because the bed of the river had been raised two or three feet since he built his mill. Would not that be an obstruction to his trade?—Yes, but I never heard of such a complaint.

7888. Another manufacturer, whose entire power depends upon his water wheel, is so backwatered that one third of the power is destroyed because the tail water cannot get away?—I never heard of that; there is very little water power in this district.

7889. There is another manufacturer who burns 2,000 tons of coal per annum, and pours all the ashes into the river. Is not some regulation required to stop that practice?—Yes; there is no objection to anything that is reasonable, and that can be done at a reasonable expense on the part of the merchants and manufacturers—it should be done; but a great deal more damage than good would come to trade if what was done interfered materially with the trade.

7890. The Chamber of Commerce I suppose is in communication with members of parliament, and watches narrowly any legislative measures that might affect trade, that might either improve it or deteriorate it?—Exactly.

7891. If this Commission should lead to any form of legislation, I assume that the Chamber of Commerce would make itself acquainted with that form of legislation, and look narrowly to it, in order to see that it was not going to be oppressive to trade?—Certainly; it would be one of their principal functions.

7892. Do not you think that the Chamber of Commerce might also consistently with its function lend some help towards carrying out some beneficial measures?—It would do so, no doubt; but it is impossible to give an opinion as to what the Chamber will do until we see what is proposed by Government to be done.

7893. It is not sought to destroy the trade of the country?—No; I am not aware that there is any intention of that kind.

7894. (*Professor Way.*) There is an intention not to do so?—The Commission, as far as I am aware, is not looked upon with any jealousy whatever.

7895. (*Chairman.*) Do you know the becks flowing through Leeds?—Yes.

7896. In what condition are they?—They are very foul; the Sheepscar beck is very foul from dye water and tanning and other things, and from linen bleaching.

7897. I suppose that if mechanical or chemical means could be devised to purify that water it would be a very great advantage?—A very great advantage.

7898. (*Mr. Harrison.*) Leeds and Bradford are the centres of a very considerable woollen district, are they not?—Yes, they have two distinct trades.

7899. They are both connected with wool?—Yes, but in two different shapes; one is carded wool and the other is combed wool. One will make cloth and will felt, the other will not felt but will make worsted, and is consequently almost entirely used for ladies' dresses.

7900. Leeds being the seat of the woollen manufacture and Bradford of the worsted?—Yes.

7901. How would you describe Huddersfield, Halifax, and Dewsbury?—Huddersfield, Dewsbury, and Leeds carry on a similar trade. There are, of course, specialities; for instance, at Dewsbury they make coatings for top coats a great deal, pilot cloth, and so on. Huddersfield is a great deal in the fancy trowsering way, and also makes cloths. Leeds makes broad cloths and fancy dresses for ladies, fancy woollens and summer coatings, and also fancy coatings of various descriptions. At Halifax there is a great woollen trade done, especially in the neighbourhood of Elland, down the banks of the Calder; but Halifax is much more a stuff market than a woollen market.

7902. What are the seats of woollen manufacture in all its branches, whether woollen or worsted, in other parts of England?—There is a worsted manufactory at Norwich, a little is done at Wakefield, but not much I think. The woollen manufacture in England is at Kendal and in this district in Yorkshire, and a good deal is done at Bury in Lancashire in coarse woollens. The flannel manufacture is done in Rochdale and in North Wales; then there is the west of England, Wiltshire, and part of Somersetshire and Gloucestershire, and I think a little is done at Exeter. These are the only districts connected with the woollen trade that I am aware of.

7903. What quantity of wool is now imported into England altogether?—I have not brought that information with me; I can furnish it to you if you wish it.

7904. Could you give it to us for a number of years past, so as to show the gradual increase in the importation?—I could; in fact every year there is a return of all the imports and exports. I could not give it to you for the last year yet; I shall get it about January. Nearly all which is used here is imported; that used at Bradford is nearly all grown in England.

7905. Could you give us the quantity which is used in this neighbourhood within the Yorkshire woollen district?—No; I could make a guess at it.

7906. Could you give it to us pretty closely?—I could not give it to you very closely. A great deal of wool comes to this neighbourhood which is sold into other neighbourhoods; this has always been a great wholesale market for wool. This wool is bought in Germany and Gibraltar and London, and is principally sold in the neighbourhood, but a great deal is sold out of the neighbourhood.

7907. (*Chairman.*) Then the aggregate imported into England would be no test of the extent of the manufacture in this neighbourhood?—The woollen trade here I should think has increased as much as anywhere, except in Batley and Dewsbury, but there there is a great deal of shoddy, but it has not increased so fast as other trades have.

7908. (*Mr. Harrison.*) Shoddy is made from woollen rags and waste?—Yes.

7909. Can you give us the quantity of woollen rags imported into England year by year?—Yes, for a few years back.

7910. Is there any large shoddy manufacture existing in this neighbourhood?—There is not much here; a little mungo is used.

7911. Where is it manufactured?—It is made all over the district; it is made here, and it is made in Dewsbury and Batley to a very great extent, and it is

also made about Huddersfield. It is imported by all these districts.

7912. Have you any means of ascertaining the quantity of English grown wool?—Yesterday evening I was at a meeting with the president of the Associated Chambers of Commerce, that is an association of all the chambers of commerce which meets in London, and that question was gone into; but until the last six months there was no means of knowing that fact, it was merely guessed at, but the guess appears to be tolerably near the mark, because from the returns for the cattle plague we now know the number of the sheep in London pretty approximately, and by taking each county we can form a pretty good idea of the weight of fleece. It is about 152,000,000 lbs.

7913. Can you give us the weight which has been used for some years past?—Bradford is much more interested in it than we are. We do not use much English wool, and have not done so for some years past.

7914. Do you think that there has been any considerable increase in the quantity of wool in England?—We have no statistics upon that point, but I do not fancy that the increase has been very great, because for many years at Bradford there have been great complaints of the scarcity of raw material. In fact some attempts have been made to increase it if possible.

7915. Have you any similar information as to the hides imported into this neighbourhood?—I was present when Mr. Tatham was giving his evidence. Several months ago the quantity was estimated at about 52,000 a week, and I think that that is about a fair estimate.

7916. That is the quantity used in this neighbourhood?—Yes; it is I suppose the largest tanning place in the empire.

7917. How is that as compared with the total?—The hides are not all imported. For instance, comparatively few sheep hides are imported. A large number of sheep's hides are produced in the country. We have had no agricultural statistics till lately. The farmers I believe generally objected to giving these statistics, and it is only the cattle plague which has brought them out. Besides the hides produced in the country a great quantity come from South America, but this trade has been principally in the East Indian hides, what we call kips. I will consult some of the tanners upon that point.

7918. From what countries is wool chiefly imported?—Principally from Australia and the Cape, and a little from Germany.

7919. Can you particularize places when you make out the return of the quantity?—Yes. As to German wool, I can only state what is imported into England, and I think that the great bulk of it goes into the west of England. Long within my recollection we were altogether dependent upon Germany and Spain. I include in Germany Hungary and Poland, but now the amount so imported is little I believe compared with the amount from Australia and the Cape. We also import here a considerable quantity of Brazilian wools which are used for felt carpets, but there is only one house in that trade here.

7920. Have you any facts as to the importation of alpaca and mohair?—We do not use any of it here at all; that is entirely a Bradford trade.

7921. Have you any further observations to offer?—I was talking about fish in the river. It is only three years ago that I saw a man catch 14 or 15 dace. In the last three years I have seen fish caught by fly fishing. The river is bad, but you may make it out worse than it really is.

7922. (*Professor Way.*) And it is probable that it will be made worse if things go on as they are going?—It is getting bad and no doubt something wants to be done.

The witness withdrew.

Adjourned to to-morrow at 10 o'clock.

Leeds, Friday, 9th November 1866.

PRESENT:

ROBERT RAWLINSON, ESQ., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, Esq. | Professor JOHN THOMAS WAY.

Mr. STEPHEN TODD HOLROYD (Leeds) examined.

7923. (*Chairman*). Are you in partnership with your father?—Yes.

7924. Do you carry on dyeing on Sheepscar Beck? Yes, stuff dyeing.

7925. Where is the stuff manufactured?—In Halifax and Bradford.

7926. They send it to you to be dyed?—Yes.

7927. How many hands do you employ?—About 130.

7928. What advantages have you in Sheepscar Beck over the people at Halifax and Bradford who send their goods that distance to be dyed?—None at all that I know of. It happens that we are the oldest firm in the trade.

7929. Where do you get water from?—From the Gipton Beck.

7930. What quantity of water do you use in your processes in a day?—About 200,000 gallons.

7931. What weight of stuff do you dye per day or per week?—I have no idea.

7932. Is the water that comes from that beck pretty pure?—Yes.

7933. Are there no mills or manufactories upon it?—None at all.

7934. Are you situated near the junction of it with the Sheepscar Beck?—Yes.

7935. Have other manufacturers power to take that water besides yourselves?—No.

7936. If manufactories were to be erected upon that beck above you how would you be situated?—We should have either to obtain an injunction to stop them, or to stop the dyeworks.

7937. Do you think that if manufactories were established there it would be an injury to you to such an extent as to justify you in applying for an injunction?—Certainly.

7938. At what cost could you replace those 200,000 gallons a day if you were debarred from getting them from that beck?—If we had to get it from the town we must pay 6*d.* per 1,000 gallons, and if we bored for water the expense would be several thousands of pounds.

7939. If you were to obtain it from the water company it would cost you 5*l.* a day?—Yes.

7940. Or 1,500*l.* a year?—Yes.

7941. That beck is worth to you from 1,000*l.* to 1,500*l.* a year?—Yes.

7942. Do you know the condition of the river Aire and of the Sheepscar Beck itself?—I have not had anything to do with the Aire.

7943. But you know the condition of it?—Yes.

7944. In what condition are the waters of the Aire and of the Sheepscar Beck? Are they in a satisfactory

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condition or suitable for purposes of dyeing?—Certainly not.

7945. You would not have manufacturers at Halifax and Bradford sending goods to you to be dyed if you took water from the Sheepscar Beck?—No; we could not carry on the business at all if we used that.

7946. Could you if you were situated on the Aire?—No.

7947. What is done with the refuse from your dye-works?—It is turned into the Sheepscar Beck.

7948. Has there been no injunction obtained against you for doing it?—No; our works have been there since 1780, there were few mills or factories below us than existed when the works were established.

7949. Do you dye the goods by weight or by the piece?—By the piece—the stuff goods.

7950. Are those pieces of different lengths and widths?—Yes.

7951. According to their lengths and widths you are paid, I suppose?—Yes.

7952. And according to the character of the dye that you use?—Yes.

7953. How much do the pieces vary in weight?—From 10 lbs. up to 60 lbs. or 70 lbs.

7954. How many pieces may you dye in a year?—We dye upon an average 3,000 a week, but we vary a good deal.

7955. At what would you put the average weight of those pieces?—I do not know, they vary so. They vary according to the seasons and the demand; sometimes we have most of one kind of pieces and sometimes most of another. I have no correct idea.

7956. Are the majority of the pieces of the heavier or the lighter kind?—The heavier; most of them are furniture goods, damasks and reps.

7957. And they run to about what weight?—From 20 lbs. to 30 lbs., and upwards.

7958. What do you do with the dyewoods that you use; I mean the refuse?—That goes into the beck.

7959. Have you ever utilized it by burning it?—No; it is rasped, not chipped; we could not get it out of the water, it runs off with the water.

7960. You could by screening, could you not?—Yes. We only use about 100 tons a year of wood, we use more of cochineal.

7961. (*Professor Way.*) Is the wood principally at the bottom or the top of the vat?—At the bottom.

7962. It is heavier than the water?—Yes.

7963. What are the colours that you principally dye?—Crimsons and greens.

7964. What materials generally do you use for crimson?—Cochineal.

7965. You do not use aniline dyes?—To a slight extent we do, but they are so fugitive that they do not answer for the kind of furniture goods we dye.

7966. That objection has not been got over in the case of the aniline dyes?—No.

7967. It was the first objection started as to them 15 years ago?—Yes.

7968. They will not bear the light, I believe?—No.

7969. The crimsons then are produced by cochineal principally, and the greens by what?—By extract of indigo and fustic extract.

7970. You do not use many chemical materials; you do not dye a variety of colours?—Not to a great extent.

7971. They are principally shades of crimson and of green?—Yes.

7972. Fustic is a wood is it not?—Yes, and besides that, there is logwood and Nicaragua wood.

7973. Those are rasped are they not?—Yes.

7974. To what size are they rasped; if you take up a heap of the rasped wood, would the liquid run through your fingers?—It is like sawdust.

7975. Would there be any difficulty in straining the liquid through a wire sieve, so as to keep back the solid stuff?—We might do it, I suppose.

7976. Is the quantity of the solid stuff which is discharged from your vats in the course of a week large?—No, we only use about 120 tons of all sorts of wood in a year.

7977. You have a large number of dye vats, can you form any notion of the quantity of water you use in absolute dyeing?—No.

7978. How often are the vats emptied?—Sometimes twice a day, but generally once. They are not vats, we do not call them vats; vats are used for dyeing indigo blues. Some of them are made of lead with copper bottoms, and some are made of block tin with copper bottoms, and there are also stone cisterns.

7979. What are they called?—We call them leads when they are made of lead, and kettles when they are made of block tin.

7980. What do they call those made of stone?—They call them cisterns.

7981. Can you form any notion as to how many of each kind of vessels you have; how many leads, for instance?—We have about 10 leads, 6 kettles, and 6 dyeing cisterns.

7982. Are they all of one size?—No, of various sizes.

7983. What is the size of the smallest?—I have no idea of the capacity of them.

7984. Can you state the size judging by the eye?—The smallest would be about three feet by four.

7985. Then the largest, are they twice that size?—They have three or four times the capacity.

7986. How many of them do you think there are?—About 10 altogether.

7987. Is there as much capacity in the kettles and in the cisterns?—No, we have not quite so many kettles.

7988. They are not so large?—Some of them are quite as large, and some are smaller. The stone cisterns are larger than either, but they are square; they will be about, I think, five feet deep, and perhaps as much in diameter.

7989. Five feet each way and five feet deep?—Yes, I think so.

7990. You say that those are emptied, according to circumstances, once or twice a day?—Yes.

7991. I suppose the liquid runs straight into the Sheepscar Beck?—Yes.

7992. The goods have to be washed, I suppose?—Yes.

7993. I suppose the remainder of the water required to make up the 200,000 gallons would consist partly of condensed water for the engines and partly of the water used for washing?—Yes.

7994. So that if we could form a notion of how much you used in your leads and your kettles we should also ascertain how much was used for washing?—Yes.

7995. Does the wash water go out much discoloured?—No not very much; at first it does, but not subsequently.

7996. Towards the latter part of the process, I suppose, the water gets very clear indeed?—Yes.

7997. You wash scrupulously up to the last point?—Yes.

7998. You stated just now that the water of the Aire or the water of the Sheepscar Beck would not do for your goods at all, either for the dyeing part of the process, or the washing?—Neither.

7999. What would be the effect of it upon the washing?—It would change the colours.

8000. Would that be in consequence of the dirt settling on the cloth?—Yes, it would be partly from that, and partly from the acid or the alkaline character of the water.

8001. It might be partly from the mechanical and partly from the chemical action?—Yes.

8002. Suppose there was no chemical property in the water, neither alkali nor acid, would the dirt in that water be objectionable?—I should say so; it would destroy the brightness of the colours.

8003. Supposing that the river could be so dealt with, that without being as pure as at its sources it was bright and free from that dark colour, and free from objectionable acid or alkali, do you think that the circumstance of its being a little hard, or not so

pure as pure water, would prevent its being used for some part of your processes?—No; it might be used for some purposes.

8004. The great difficulty lies, in fact, in its dirtiness?—Yes; I should say so.

8005. You happen to have tolerably good water?—Yes.

8006. Would it be a great advantage to others to have water that was moderately pure?—Yes; certainly.

8007. And to the trade generally?—Yes; we do not come much into competition with the Leeds dyers; we dye a different class of goods.

8008. (*Chairman.*) Are they dyers chiefly of cloth?—No; there are both cloth and stuff dyers, but they dye a different kind of goods, principally dress goods.

8009. (*Professor Way.*) If you exchanged with them goods to be dyed you could dye theirs readily, but could they dye yours?—No; not with the river water.

8010. You could dye theirs, because pure water is not objectionable for dyeing?—Yes.

8011. I suppose, considering the delicate colours you dye, you would not have maintained that trade if you had not had pure water?—No.

8012. You would have drifted, perhaps, into a different set of colours?—Most likely.

8013. You were asked just now how it happened that the Bradford people sent their goods to you to be dyed; how is that?—In the first place we were dyers before there were any goods made in Bradford of that class; my grandfather, I believe, was the first to introduce the stuff dyeing trade into this part of the country.

8014. If they could dye equally well at Bradford, and skilled labour could be obtained there, do you think they would not attempt to do it, if they could dye your colours at Bradford?—They do dye a good deal of the same class of colours that we do, but still we can maintain our trade, and get rather a better price than they can.

8015. Is that from your name, or the quality of the goods?—The quality of the goods.

8016. Is the difference in the quality of the goods in any way attributable to the Bradford people not having such good water as you have?—Partly so, and partly for this reason, that I do not think they give such good colours; they do not, perhaps, go to the expense; they make more profit out of the trade.

8017. Is good water obtainable readily at Bradford?—I believe not, except by boring.

8018. Not in the streams?—No.

8019. Nor except by the water company's supply?—No.

8020. (*Chairman.*) According to a map I have here, Mr. Fleming's geological map of Yorkshire, the becks from which you take the water appear to rise and pass over a coal formation. Is that the case?—I do not know—no, I should say not; there is very little coal obtained where the Gipton Beck runs; it is just at the outskirts.

8021. Is any coal obtained from there?—Yes.

8022. Are those collieries in work now?—Yes.

8023. Are there any old ones near the beck?—No.

8024. Do those collieries send any water into the beck?—One does.

8025. What is its quality?—That is very good; it kept our works going almost all last summer.

8026. Do you know the seam of coal they are working?—I believe it is the Lowmoor bed.

8027. Are you aware that from some of the beds they derive very good and useful water, but from others the water is injurious?—No; I am not aware of that.

8028. Have you ascertained the quality of the water you obtained; have you had it analysed?—No.

8029. Is it soft water?—Moderately; it is not so soft as the water in the Sheepscar Beck.

8030. The Sheepscar Beck rises in the millstone grit does it not, to a considerable extent, and, as you say, the probability is that the water would be really softer in the Sheepscar Beck?—It is said that the Sheepscar Beck water is the best in the borough for boilers.

8031. In dyeing very bright colours, do you find that the smoke of Leeds effects you at all?—No; I do not know that it does, except the smuts that fall occasionally.

8032. Do they fall occasionally on your cloth when you are dyeing?—Yes.

8033. Is that injurious to the cloth?—We can avoid it by taking care and covering the pieces up.

8034. (*Professor Way.*) Is it in the dye-house or in the transit of the goods, when the goods are coming out, that you get the smuts?—It is in the transit generally.

8035. The smuts do not fall in such a quantity into the beck or about the premises as to injure the water?—No. We used to be able to dry the goods and also to cool them, (they have to be cooled in certain processes; they are laid down to get a little damp) but we cannot do that now. We do that upon the premises in covered places. We used to lay them on the grass.

8036. Do you use steam power to any great extent?—Yes.

8037. Of how many horse power?—Between 20 and 30. It is one of the first engines that was put up in Yorkshire.

8038. What quantity of coal do you consume per annum?—20 tons a day.

8039. What quantity of ashes do you use?—I have no idea.

8040. What becomes of them?—They are taken away for the roads.

8041. Do you find no difficulty in getting rid of them?—No, we pay 2*d.* a load.

8042. You do not turn them into the beck?—No. We give the men who fetch them 2*d.* for drinking, and they take them away.

8043. Have you any spare space in your mill. Have you a yard attached to the mill?—Yes, both a yard, a field, a garden, and a reservoir.

8044. Supposing it was suggested that anything should be done with the waste dye water before it is discharged into the Sheepscar Beck, would you have space for small tanks for the treatment of it? For instance, have you got 100 square feet or yards unemployed at this moment?—We have nearly that space, but it would necessitate putting a new drain down, because the liquid now falls into the beck at various points.

8045. You are not circumscribed for room?—No, not particularly.

8046. Supposing that for a moderate expense you could purify the liquids that you now throw into the Sheepscar Beck, and that one rule was to be applied to all dyers and polluters of the river alike, so that the river generally would be in a very different state to what it is now, would you think it was right and fair that you should be asked to expend a small sum annually in purifying the water used on your premises before discharging it into the beck?—If everybody was placed on the same footing it would not make much difference except that we have to compete with foreign dyers.

8047. You get pure water and you believe you have power to prevent anybody from making it impure?—Yes.

8048. You are therefore exceptionally situated; there may not be another dyer so well situated. I suppose you would feel that it was not right that you, having accidentally good water, should help to make the water bad for the other dyers?—No.

8049. You would have no right to be exempted from any rule that might be laid down?—No.

8050. If every man was called upon to purify the water, every man would get the pure water that his neighbour had purified in return for the expense he had been put to, but you would get it without expense?—Yes.

8051. Therefore you may form an impartial opinion as to what might be the state of things if it were possible at a moderate expense to purify the water.

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Do you not think that some reasonable measure should be made incumbent upon all manufacturers alike?—I do not know why it should not. We have to compete with the French dyers principally, and we are just beginning to find that in consequence of the increase in the wages, and the increase in the price of coals, and various increases in expenditure, we are at disadvantage, and we fear that part of the trade may leave us and go to France.

8052. (*Mr. Harrison.*) During the inquiry at Wakefield we found that the dyeing operations had been removed from Wakefield to a considerable extent in the course of many years. Do you know that to be the fact?—Yes.

8053. That was consequent in some measure upon the pollution of the river Calder. Has there been any such effect produced by the condition of the river Aire at Leeds, and has that been the cause of the removal of the dye works?—I believe not.

8054. Is there as much dyeing carried on now as there ever was?—Yes; only that it is in fewer hands.

8055. Is it of a different character from what the dyeing was in former years?—Partly it is. In the stuff trade it is partly so.

8056. Are the colours that are dyed, excepting your own, as bright colours as they used to be, or are they darker colours which do not require such pure water?—They dye light colours yet, but they have to use either the town's water or bore-hole water.

8057. You say that you are obliged now to dry your stuff within the house instead of exposing it, as formerly, upon the grass?—Yes.

8058. Are you put to any expense for that purpose?—Yes; only that out of doors we could not dry the quantity that we do now, even if it were possible to dry the stuff on the grass.

8059. What is the expense in coal that you are put to annually for drying?—I cannot tell, because we dry by steam. We have drying machines with steam cylinders connected with the boilers.

8060. Is any considerable quantity of the coal you mentioned that you use weekly used for the purpose of drying your stuffs?—No; no considerable quantity.—The quantity of water in the Sheepscar Beck is very much reduced to what it used to be.

8061. From what cause is that?—I believe that when the waterworks were established part of the streams were taken to the Eccup reservoir.

(*Mr. Filliter.*) I believe that is not the case.

8062. (*To witness.*) Have not the manufacturers on the Sheepscar Beck a reservoir of their own?—At Addle there is one. I do not know to whom it belongs.

8063. Under whose management is it?—Nobody's that I know of.

8064. How is it worked?—It is not worked at all, I believe.

8065. How does the water get out of it?—It runs out.

8066. It is merely a leak, I suppose?—That is all, I believe.

(*Mr. Filliter.*) It is worked, but I do not know by whose authority. It is now full. Occasionally it is empty; but I cannot tell under whose authority it is.

(*The witness.*) Some years ago it was proposed to clean out that Addle Dam by Mr. Eddison. I believe he intended to go to Parliament. He intended to maintain it in working order and to tax the owners on the beck for it, but he was opposed by the millowners on the beck successfully.

8067. What was their ground of opposition?—I forget.

8068. Would it not be a desirable thing for the millowners to have that as a kind of compensation reservoir?—Yes; but at that time we did not want to be taxed for it.

8069. Are you aware that they place considerable value upon the water of the Sheepscar Beck as water power?—Yes.

8070. What reason have you for saying that is diminished?—Because 20 years ago we washed all the goods in the beck; they were thrown into the beck, and the lengths floated down, and even if the water was pure now, we could not do that; there is not water to float the pieces down.

8071. Are there many manufacturers between your mills and the upper part of the Sheepscar Beck?—Yes, a good many now.

8072. Do those manufacturers take water from the beck for engine and dyeing purposes?—Yes.

8073. During those operations would not a great deal of that water be evaporated?—Yes, it might be; at the same time there are many bore-holes that throw their water in. The manufacturers use more water than they get out of the beck, and they throw the refuse water into the beck. I believe also that in carrying out sewerage they have turned several little springs into the sewers.

8074. Have you any water power on the Sheepscar Beck?—No. I do not think that anything we turn in would be prejudicial to the health of the inhabitants on the beck, the water being impure before it comes to us; the quantity of acids and alum and chloride of lime that we throw in would perhaps have a neutralizing effect rather than otherwise. I do not say that if the water was pure what we turn in would not spoil it.

8075. Have you not waterclosets on the premises for the use of the men you employ?—No waterclosets—common privies.

8076. Where are they situated; over the beck?—No, they are not far from the beck, but we take all the soil up to our farm.

8077. You have it carted away regularly?—Yes.

8078. (*Chairman.*) Do you know whether the land above you has been drained within the last 20 years?—I should say that it has been about Addle.

8079. Would that have any effect in diminishing the summer flow in the beck?—I do not know.

The witness withdrew.

Mr. C. L. Dresser, C.E.

Mr. Christopher Leefe Dresser, C.E. (Headingley), examined.

8080. (*Chairman.*) Where do you reside?—I have just left Swillington, which is about seven miles down the river, to come to Headingley. I had lived three years at Swillington on the Lower Aire.

8081. Have you been engaged professionally in this district?—I have been living there.

8082. Have you been engaged on the works here?—No; but I have made several experiments.

8083. You are a civil engineer and a Fellow of the Chemical Society in London?—Yes.

8084. How long have you known the river Aire?—For 30 years.

8085. In what condition do you find it now as compared with what it was 30 years ago?—It is very much altered indeed.

8086. In what way?—It is altered in its appearance and it is altered in its character; altogether, as regards the smell and thickness and look of the water; in short in every way.

8087. Have you analysed the waters at all?—I have not analysed the water of the river, but I have analysed a great many waters about in this district. What I principally wish to call attention to is the condition of the river at Swillington Bridge, which is below the point where the drain enters the river.

8088. You mean the main sewer of Leeds?—Yes.

8089. Did you know the river before the main sewer was constructed?—I did.

8090. Have you examined the condition of the river since the construction of the sewer?—Yes, repeatedly.

8091. What is the difference between the state of

the river before that sewer was constructed, and its condition now ?—Before the drain was made all down the banks where I had been accustomed to pass twice a day the water was clear, and they used to catch fish all the way down, but now the condition of the river at Swillington Bridge is so opaque that you cannot see two or three inches into it, and the offensive smell both from the dye wares and from the sewer is in summer time so bad that I have frequently had to put my handkerchief to my mouth when crossing the bridge.

8092. Do you think that the sewage or the other forms of pollution are accountable for killing the fish ?—I do not think that the sewage is accountable for it, and I will give you a reason. I have been improving a town further down the river for the late Lord Palmerston—Fairburn,—draining it, and we have run a drain into a large open cut, which drains the land, but at the bottom of the drain we have a settling pond; we allow the water to settle first, and then it is run from the settling pond into the cut, which contains clear water. It runs in thick and comes out quite clear, and it has not affected the fish in the cut at all. It has only been done recently and the fish are as lively as ever, and I have noticed that just at the mouth of the drain where it runs into the cut an enormous increase in aquatic life, for shell-fish have multiplied to such an extent as almost to stop up the other drain.

8093. (*Mr. Harrison.*) How long is it since that work was executed ?—Scarcely 12 months.

8094. Within that period could you judge of the effect ?—The sewage is decomposing continually. I find that by the large quantity of gas that bubbles up in the settling pond.

8095. Do you find that it bubbles up in the settling pond and raises masses of black fœtid matter ?—I do not think there has been time for the black matter to form at the bottom.

8096. When you get to that condition of things and there is a large deposit fermenting, the gases may have a different effect ?—Yes.

8097. Sewage when fresh may be food for fishes, but sewage when decomposed and fermenting may be their death ?—It is quite possible, but the work has been done too recently to be able to give an opinion ; of course, it is a very different form of sewage from the sewage of Leeds.

8098. How long is it since the sewer from Leeds was completed ?—I cannot say, I think nearly a dozen years.

(*Mr. Filliter.*) About 14 years, I believe.

8099. (*To the witness.*) Did you know the river at that time ?—Yes, intimately.

8100. Was the effect produced upon the river immediately after the execution of the sewer, or has the mischievous effect been cumulative ?—I think it has been cumulative, and the dye matter has been continually cumulative.

8101. Are you aware that a large portion of the borough of Leeds is not thoroughly sewered, that cesspools are frequent, and that there is not a system of sewerage thoroughly carried out ?—No. I do not think cesspools are very numerous in Leeds. I have had a great deal to do with sewering part of the town.

8102. With an increase of sewage matter thrown in, what will be the effect upon the river below ?—I think it must continue to be disastrous ; the effect at present is very bad indeed, so bad that I think in time, if the whole of the sewage of the borough is taken into the main sewers, it will breed miasma, and probably cause fever all round the river side. I know that at Swillington Bridge and thereabouts it is very much complained about.

8103. What towns and villages are situated upon the banks of the river below Leeds that would be affected by this condition of the river ?—There is Methley.

8104. What number of inhabitants are there in Methley ?—I cannot say ; it is a considerable town.

8105. Is it close upon the banks of the river ?—Yes, it is within a few hundred yards, then comes Castleford.

8106. What is the population of Castleford ?—I really cannot say ; it has been increasing so rapidly of late.

8107. Is it one of the Yorkshire towns which is rapidly on the increase ?—Yes ; from this cause, that it has become the centre of the glass-bottle trade.

8108. Are there any collieries in the immediate neighbourhood ?—Only one that I know of, and that is just commencing ; it has scarcely got to work yet, there are others between that and Wakefield, a good many, within a few miles.

8109. Is this bottle trade likely to give rise to a considerable population ?—It has given rise to a very large population.

8110. And an increasing one ?—Yes.

8111. Do you think that Castleford will be injuriously affected by the state of the river ?—It is situated immediately on the banks, but the Aire receives the Calder before it reaches Castleford.

8112. They unite close to Castleford, do they not ?—Just about there. I have experimented on the outlet of the Leeds drain a good deal. I have frequently passed it, and I wished to see whether the gases really emanated from the drain, or did not. I have frequently hung a feather by a slight thread across the mouth of the drain, and observed the effects. I have done that, I should think, a dozen times in all the different states of the atmosphere and the wind. The drain empties itself in an easterly direction, and I have found that whenever the wind has been in an easterly direction the feather has been invariably drawn into the mouth of the drain. When the wind has been northwardly or westwardly, the reverse has been the case ; when the feather has been drawn into the drain there has been no smell whatever from the drain, none except merely from the water that was running ; but in the other case it is almost impossible to get near the drain, the effluvium is so strong, almost beyond endurance.

8113. When the wind is in the east that effluvium would be driven up the drain ?—Yes, that is of course the inference, and then all the noxious gases are emanating into the town.

8114. According to the strength of the wind so would be the pressure ?—Yes, I have frequently noticed when there has been a calm that there has been neither an inlet nor an outlet, but a complete stagnation at the mouth of the drain.

8115. These gases would be still forming within the drain ?—Yes, because immediately the sewage comes out of the drain they are bubbling—I could see them bubbling inside the drain by looking up.

8116. So that the drain is a large gasometer of a certain kind ?—I have no doubt that that must be the case in certain states of the weather.

8117. Are there outlets for that gas ?—I am afraid that outlets exist that are scarcely suspected. I have had a good deal to do with valuing cottage property in the borough, and I have frequently found the trap from the sink loose and pulled up to let a larger quantity of water flow down. That is to a certain extent a reason why, amongst other causes, I think the gas gets into the town. It is possible, I think, that in the higher parts of the town the pressure of the gas during a strong easterly wind may be so great as to bubble through water.

8118. Have you perceived gases rising from the sinks you have mentioned ?—Yes.

8119. Have you ever examined the character of those gases ?—No, I have not, but being accustomed to chemical matters I can say generally what they are.

8120. Do you know that water will surcharge itself with gas, and that the gas will then be transmitted almost as if there was no intervening water ?—Yes.

8121. That a water-trap may be a delusion and a snare ?—I believe it is often so.

8122. If you had a drain highly charged with noxious gases, the water may take them in below and

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give them out from the surface?—Yes, the water will absorb a large quantity, and will then absorb no more, and if there is pressure going on, the gas will emanate at the surface.

8123. (*Professor Way.*) There is a law of diffusion which makes the gas escape into the air, even though it has to pass through water?—Yes; the gases that are generated in sewers are of a light character, and have a tendency to rise.

8124. (*Mr. Harrison.*) That shows the importance of carrying out a system of ventilation, does it not?—Yes; I have frequently written in the Leeds Press advocating a thorough ventilation of the drains; but I am sorry to say that outsiders very rarely have any attention paid to their wishes.

8125. Have you seen any means of ventilation carried out in any case?—No. The plan I recommended was to construct in the higher parts of the town some chimnies, and to place in them a coke fire that could have no chance of receiving air except what it drew from the drains, and keep the fire continually burning. If the air is passed through a fire all the noxious qualities of the gases will be, I think, decomposed. When the barometer is lowering I think the escape of gas will be in the lower part of the town.

8126. (*Chairman.*) If you have a plan of the borough of Leeds before you with the Leeds sewers upon it you will see that by intervening shafts and flat valves you could break the system of sewers into as many sections as you thought proper, and compel the gases to come out at such points as you required?—Yes; that is the plan I am carrying out.

8127. You would thus be master of the position?—Yes, except in certain barometrical states of the atmosphere.

8128. And there you would operate by a shaft?—Yes, with a fire in it that could draw no air whatever except from the drain.

8129. Are you aware that if you have a vertical shaft there is always a current up it?—I am afraid my experience does not carry me to that extent. I have been engaged very extensively in mining operations, and we have shafts for ventilating in that way, and we find that sometimes there is a current the other way—a downward current.

8130. If there is any downward current into the mine there must be a corresponding emission of air at some point or condensation going on?—It always looks as if there was condensation going on, for this reason, that when we find the air in that state the men cannot get into the mine; there is such an accumulation of carbonic acid in the mines then that the men are driven out.

8131. There are states of the atmosphere when there is no tendency to motion?—Yes, certainly, not upwards.

8132. Have you been in the Tropics?—I have been in Africa.

8133. Have you ever lived where it is necessary to use a punka?—I have been in Africa. I believe that is used in India.

8134. In the same way in this country you may want something to produce motion in the air?—Yes.

8135. Do you believe that change of air is apparently more necessary than purity; in other words, that an impure stagnant atmosphere may kill, but an impure atmosphere in motion may do very little injury?—I can quite conceive that.

8136. Therefore, whenever the atmosphere is in that stagnant condition the evil effects are most to be dreaded?—Yes.

8137. Are you aware that the Registrar General lays it down as one of the principal ingredients in an outbreak of cholera, that there will be found a still atmosphere?—I understand that that is the general impression. I know that means have been resorted to to move the atmosphere.

8138. (*Mr. Harrison.*) Did you say that you had been connected as engineer with lead mines?—Yes, large ones.

8139. Are there many lead mines within the basin of the Aire and Calder?—There is a large one above Bradford belonging to the Duke of Devonshire, that is called Cononley Mine, and it is in the millstone grit formation in the basin of the Aire.

8140. Are you mining engineer to some lead mines in the valley of the Nidd?—I was for several years.

8141. What are the pollutions that arise from lead mines?—It depends a good deal upon the strata in which the lead mines are worked; if the veins are in the millstone grit the lead ore is largely mixed with coke or sulphate of barites, and that in order to get the lead out is ground to powder and washed, and the pulverised barites is taken up by the stream and floated away. That gives a very strong colour to the stream for a great distance, and I believe it to be very poisonous, I mean the sulphate of barites. We find that when cattle drink such water it has the effect of poisoning them.

8142. (*Professor Way.*) Is the sulphate of barites roasted?—It is sometimes burnt.

8143. With fuel?—Yes; and that would change its character; as a rule, it is merely crushed.

8144. Do you think that sulphate of barites is poisonous?—Yes; I am merely speaking from experience.

8145. Do you think there is some lead in it?—It is very heavy, there may be arsenic in it; I have no doubt there is. We take all the pains we can to keep the lead back by settling ponds.

8146. (*Mr. Harrison.*) In the cases in which you have experienced the poisonous effects, has it been where there has been no roasting but simply crushing?—Yes, no roasting, but simply grinding.

8147. There is a large quantity of water used I believe in the process of separating the lead ore?—Yes.

8148. And you take great pains to separate as much of the ore as possible?—That is so.

8149. Can you recommend any means by which the water which is polluted, and contains arsenic and barites, may be prevented from passing down the river and becoming injurious?—By settling ponds the evil would be avoided to a great extent.

8150. In time do you think that the greater portion of the matter would subside and be no longer passed on injuriously?—That is my experience, I have found it so.

8151. Have you had, in any case, injunctions brought against you for passing that water down the river?—No, because the becks on which I have operated have been used for washing for so many years that it has become a known fact and no person opposes it.

8152. Have those becks fish in them?—None.

8153. For what distance down do you find that the lead mines have destroyed the fish?—For four or five miles down. There is a beck near one of the mines which runs about five miles before it enters into the Nidd, a side beck, and there are no fish whatever in that beck, but there are fish in the Nidd.

8154. Was the pollution from the beck sufficient to destroy the fish in the Nidd?—Yes; it had a very strong effect in the river; above where the beck entered fish were in abundance but below they were scarce indeed.

8155. In that case had the water passed from subsiding ponds?—No.

8156. In cases where you have had subsiding ponds have you found the water equally destructive to the fish?—I have not made that observation; the water is clearer, it has lost its sediment to a great extent.

8157. Is there any difficulty in carrying that water back for the purposes of rewashing the ore?—That is a matter of pumping, of course. The quantity used is very large, and to have to pump it would be considered, I am afraid, an impediment.

8158. Can you give us the quantity of water that is used in washing a certain quantity of ore?—No, it is very various with different operators, some use less and some more.

8159. You are not now a mining agent?—No.

8160. You have not made any observations your-

self?—Not as to the quantity of water used. In summer time we have been stopped for want of water.

8161. Did you take any steps to pump back the water that you were using?—No. When we found that we were short of water we set to work to make reservoirs above. We had some extensive wet moors with water in them and we made reservoirs on them and so stored the water.

8162. After the ore was washed was it sent away in the shape of ore or was it manufactured into pig-lead?—It was smelted into pig-lead.

8163. In the operation of refining is any refuse carried into the rivers, polluting them?—No, I do not think we carried in any at all. We used the refuse for mending the roads; it was worked up pretty well because a certain portion of the lead adheres very tenaciously to the refuse; it is smelted over and over again until there is not much left.

8164. Are long chimneys used for deposit of the lead as the fumes pass out?—Yes, we had one which I think was above a mile in length.

8165. In what form is lead deposited in those chimneys?—They call it soot, it is lead in a very comminuted state.

8166. What is done with that?—Re-smelted and turned into lead again. The chimneys are swept out occasionally and sometimes they are flushed out with water, and the soot is collected and re-smelted.

8167. From none of those processes is any pollution sent into the river?—Not from that process.

8168. Nor from any refining process?—There is none carried on in that neighbourhood, there is very little silver in the lead and they do not attempt to refine it.

8169. (*Chairman.*) Is the lead-ore found in the millstone grit?—Yes, Cononley and one of the mines of which I was engineer were in the millstone grit, the other was in mountain limestone.

8170. What is the great lead ore bearing stratification?—There has been more lead got out of the millstone grit than out of any other stratification. The veins in the millstone grit are sometimes small, sometimes of enormous size.

8171. Is the lead distributed in veins and not diffused through the mass of the grit?—It is in faults and dislocations; sometimes we find the strata on one side of a vein 100 or 200 feet higher than the same strata on the other side of the vein.

8172. It is in the lines of faults?—Yes, very large faults.

8173. Have you ever known lead-ore diffused through a mass of the millstone grit?—No; we have sometimes what we call pipes where the lead-ore is not in a vein at all but in a large hole.

8174. Do you know anything with regard to copper mines?—Only theoretically.

8175. Do you know that peculiar copper deposit near Manchester in the new red sandstone?—I have heard of it. We find lead very often very much disseminated in the veins of the sandstone mixed up with the barites.

8176. What peculiar effect has the lead in poisoning the cattle? Does it swell their joints?—I have never paid sufficient attention to it to enable me to say. I know that in my neighbourhood we have frequently attributed the death of the cattle to it.

8177. You have not heard whether it affects the gums or the joints, but simply that it produces death?—I cannot speak to that. At one time when I was engineer to the mine I have mentioned, we frequently found, when the smelting was carried on with a short chimney, that in consequence of the chimney being very short, a vapour rose from the smelt-house, and then that all the vegetation round was destroyed. The cattle were prevented by special regulations from eating anything round about.

8178. (*Professor Way.*) You know, I suppose, most of the manufacturers in this district?—I know a good many of them.

8179. The dyeworks and so on?—Yes.

8180. Do you know the nature of the refuse they throw into the river; I mean the refuse from the dye processes and from the washing, and the whole of the solutions of refuse?—Yes.

8181. Do you think, from your chemical knowledge, and your practical knowledge of the trade carried on here, that there is any hope of dealing with those liquids so as to send down comparatively pure water?—I have studied the question very closely, and I do not know of any means. I think that subsidence will not do it.

8182. There would be more prospect of succeeding if there were an object in discovering a process by which it might be done?—Most decidedly.

8183. It would hardly be worth a chemist's while now to set to work to devise a method when it would result in its being put aside?—I am afraid that theoretical views are frequently set aside. I am afraid settling will not do it, and I will give you a reason why. At Swillington Bridge there is a long reach kept up by a dam, and I have visited both the top and lower part of it, and I do not see that the water is any clearer at the bottom than it is at the top. On the other hand, there must be some effect produced by subsidence, because the farther you get down the river, the clearer it becomes.

8184. On Monday morning we have been told that the water is very often clear or comparatively so?—It is not so at Swillington Bridge.

8185. Is there not a coloured deposit at the bottom of the river?—I have noticed that at the side of the river after a flood. I have found on the sides of the river a very thick black deposit which apparently was from subsidence from the water. If you wish to have any information from an unofficial source as to the water supply for the town, probably I can give it you, having examined the question with much attention.

8186. (*Chairman.*) You know, I suppose, the proposed scheme that Mr. Filliter has laid before the corporation?—Yes. If you have seen Mr. Hunter's report on the health of Leeds, there is appended to it a very long letter from me on the character of the water supply to Leeds.

8187. What is your opinion of the present character of the water?—I should say that it is very impure.

8188. What would be the character of the water that is proposed to be brought in?—It certainly cannot be pure, because it will be derived from the most impure stream within many miles of Leeds; the Washbourn rises in several thousand acres of peat and bog, and is the most deeply tainted of any that I know of within 50 miles of Leeds.

8189. What district do you think water might be obtained from for the supply of Leeds?—I have proposed several times a district which, I believe, would give one of the best waters that could be obtained. I would have the water drawn from the tributaries of the river Yore.

8190. What is the character of the subsoil from which that water flows?—It is the millstone grit, the same as the Washbourn.

8191. Is it free from mossy deposits?—It is infinitely freer than the Washbourn; the Washbourn is notoriously the most peaty source that there is within 50 or 60 miles of Leeds.

8192. What would be the comparative cost of the works that would be necessary in obtaining the water from the two places?—According to the evidence that Mr. Filliter gave the other day, he expects to bring 23,000,000 gallons to Leeds for 317,000*l.*, that would give 14,000*l.* per million gallons. If we take the experience of Leeds and other towns we shall find an amazing difference. Leeds, in order to get its present supply, has to pay about 100,000*l.* for a million gallons; Bradford, 75,000*l.* for a million gallons; Liverpool, 115,000*l.* for a million gallons; Manchester, 60,000*l.* for a million gallons. Mr. Filliter, according to his statement, expects to get 23,000,000 gallons a day at 14,000*l.* per million gallons. That is scarcely a fifth of what others expect to get it for. The sources to which I allude would certainly give 23,000,000 or

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even 30,000,000 gallons, and I think the expense would be about 400,000*l*.

8193. The source you have alluded to you think would yield purer water, and give it in as great a volume and would be supplied at a relatively less cost?—I think so; not greater certainly; the dry weather flow of the Washbourn, when pure and clear, is certainly not more than 3,000,000 gallons a day; the flood flow is large as it is derived from a tolerably large catchment; but when it is in the slightest degree affected by rains, it immediately begins to be discoloured.

8194. What point would you take in the Washbourn where you would obtain the 3,000,000 gallons a day?—I have gauged it at various points.

8195. You do not mean to say that it would be 3,000,000 gallons a day over five or six miles of its length; it would be the greatest at its junction with the Wharfe would it not?—I have gauged it there when it was not running more than 3,000,000 gallons, when it was very clear.

8196. In very dry weather at its junction with the Wharfe the flow of the Washbourn does not exceed that?—No.

8197. What would be the dry weather flow of the stream that you would propose to take the water from?—The dry weather flow of one of the streams that I should take it from (I have gauged them many times) is about 5,500,000, and the other is about the same.

8198. What is the comparative superficies of the area of the Washbourn, and the area of the streams you would deal with?—The area of the two streams I should deal with would be about 23,000 acres.

8199. What is Mr. Filliter's area?—In Mr. Filliter's words, about 20,000 acres; but there is this great difference, that the watershed of the Washbourn is comparatively low, while the watershed of the Bourn, and of the other I propose to deal with, is nearly 1,000 feet higher.

8200. Would the water gravitate to Leeds?—Every inch of the way.

8201. What does the distance measure along the conduit that you would make to bring in the water to Leeds?—Short of 30 miles.

8202. What is the distance of Mr. Filliter's?—Perhaps 15 or 16 miles.

8203. Yours would be double the distance?—Yes.

8204. Would you have to make an impounding reservoir?—In the first instance for the supply of the town, I think not, because the dry flow of the two rivers would produce about 10,000,000 gallons a day.

8205. Do you think that the landowners would permit you to take away one drop of water without compensation in water?—There are no mills or anything of that sort on the streams which would be affected; perhaps the landowners would not acquiesce, but I should make compensation reservoirs.

8206. Would they be on the millstone grit?—Yes.

8207. Do you know what height the embankments would have to be, and of what capacities you would make the reservoirs?—I have gone into all that question, but I have not the details here.

8208. It is hardly fair to Mr. Filliter for us to receive an outline of the scheme if you cannot give us the details?—I have them all, although not at this moment here. With regard to filtering, I wish to say that I have attempted to filter this bog water. I have used various methods, and amongst others that of Mr. Spencer with the carbide of iron. I fancy it is some sort of half roasted sulphuret of iron.

8209. I suppose that any process for purifying that water would be not so much filtering as bleaching?—It is a kind of bleaching. If you suspend a coil of iron wire in water highly coloured by peaty matter, or much affected by organic matter, and let it remain a certain time, it will take the organic matter out. I apprehend that that is an instance of the same principle as that on which Mr. Spencer works, with this difference, that when you suspend the wire in water organically tainted, purification requires a considerable time, whereas in filtering, the water passes through at a great speed, and there is not time to conduct the bleaching operations you spoke of.

8210. Have you faith in Mr. Spencer's mode of filtering, or not?—I have no faith at all in it; I have found it to fail utterly in the case of bog water.

8211. Do you know whether the taint of the bog would be injurious physically, or simply objectionable on the score of colour; in other words, would an infusion of bog be more injurious than an infusion of tea?—Yes, one is agreeable, and the other is not. I do not see why we should have bog water.

8212. Speaking of tainted water, you might have a very bright water which might be for culinary purposes more objectionable than the soft water which was slightly tainted with bog. Would you prefer the Washbourn or the Thames water?—Personally the taste of bog water is very disagreeable to me.

8213. (*Professor Way.*) Do you know as a fact that the water of Loch Katrine is distributed in Glasgow and that it is constantly coloured with peat?—I have never seen it. It is very soft water, I believe. There are methods in this district of getting rid certainly of the taint of bog, which I should be prepared to point out professionally at any time.

8214. Your objection to Mr. Filliter's plan is only the bog?—I beg pardon, that is not so. There are upwards of 300 acres of wood, and the decayed leaves from the trees must affect the water. Then there is a very large number of mills and roads which are passed, and those will all affect the water. There are also a great many farmsteads that will drain into his area.

8215. Is the area that you propose to take the water from free from all those objections?—Yes.

8216. There are no bogs, nor trees, nor roads?—None. I do not think there are three mills in the area.

8217. And no farmsteads?—None; it is a wild wilderness of country lying very high indeed.

8218. Where is it situated?—Up there (*pointing to the map*).

8219. Is it cultivated?—No.

8220. Are there moors there?—There are moors, but not peat bogs. The Washbourn, I think, has 5,000 or 6,000 acres of peat bog—peat moors—where the peat is from five to seven or eight feet thick.

8221. Have you analysed the water of the Wharfe? Yes, repeatedly.

8222. What is the degree of hardness of the water of the Wharfe?—The present hardness varies a good deal. I should say it was from 8° to 10°.

8223. Was that when there was a large quantity of water?—I have analyzed it in various states of the water. I may state that I was one of those who opposed the Addle Beck scheme in Parliament, when, as the gentleman who was here last stated, there was an attempt made to reconstruct the Addle dam. I know that beck intimately.

8224. Were you engaged in that case?—Yes, by the millowners, in opposing it.

8225. What was the ground of their opposition?—It was this, that it was a company who wanted to tax them—to impound more of the flood waters and let it out regularly, and then tax the millowners for the expense, and they objected to that.

8226. To whom does the Addle reservoir belong?—I have always understood that it belongs to some corn millers just below it.

8227. To the owners of a mill just below?—Yes.

8228. Do they regulate the egress of the water at present?—They only regulate it to suit their own corn mill.

8229. They have the reservoir under their control? Yes.

8230. They are practically the owners of it?—Yes, the state of it has been getting worse year by year.

8231. They have taken no measures to cleanse it? No; and it has got into a very bad state indeed.

The witness withdrew.

Mr. JAMES HIGGINS (Leeds) examined.

8232. (*Chairman.*) What are you?—I am the cattle plague inspector of this borough.

8233. What points do you wish to speak to?—I have been meat inspector for this borough for nine years.

8234. Have you read the evidence of Mr. Mitchell?—Yes.

8235. Do you disagree with it?—Yes, I do.

8236. With what portion of it?—From the form and tenor of the evidence I am led to think that it will go forth to the public that the state of the river has been the cause of the outbreak of the cattle plague in the Thorpe Hall pastures.

8237. (*Mr. Harrison.*) That is not what Mr. Mitchell stated. He stated that the cattle plague was brought there by an animal imported into Hull, but that the condition of the river, the water of which the cattle could occasionally drink, and the condition of the atmosphere in those meadows, he thought, predisposed the animals to take the cattle plague when this animal having it was introduced among them?—That animal was brought under my own observation as inspector for this borough. It was brought into the borough in a dying state.

8238. Where did it come from?—It was bought in Leeds market; it was a foreign animal, sent with three others from Hull.

8239. (*Chairman.*) Where did it come from to Hull?—I do not know; it was a Dutch animal, black and white.

8240. It came from some part of Holland to Hull?—Yes.

8241. And then came from Hull to Leeds?—Yes; and was exhibited for sale.

8242. And had disease upon it?—I have no doubt that it was an infected animal.

8243. It went from Leeds to Thorpe Hall pastures?—Yes.

8244. Did it die there?—It was brought in a dying state out of Thorpe Hall pastures into one of the slaughter-houses for this borough.

8245. Do you think that it infected Thorpe Hall pastures during the time it was there?—Yes, I believe so.

8246. How many days was it there?—About 14 days as near as I could ascertain. The party gave me contradictory statements.

8247. (*Mr. Harrison.*) You said just now that the animal was sold out of Leeds?—It was sold in the Leeds market. I did not know of it then. I do not know that of my own knowledge, but merely from its having been stated to me. No doubt this animal was the first reported case with the cattle plague, but I had had three other cases a few days previous to this case. I have seen many thousands of diseased beasts but I never saw anything of the nature of this. I called the attention of Mr. Dray, the veterinary surgeon, to three separate cases before I called him to this one special case. The disease was not known then, not even by the veterinary surgeons here, and I have no doubt, from my experience since, that we had three separate and distinct cases out of other districts. Two of them came from within two miles of Tadcaster where the disease raged with great intensity.

8248. Where had they come from to Tadcaster?—I attributed them to a dealer at Tadcaster who was a dealer in foreign stock, and he showed foreign animals in Leeds market.

8249. Had they come from Holland through Hull?—Yes.

8250. How many days previous to this diseased animal coming into Leeds market had these other diseased animals come before you?—They followed one another in quick succession, all within about ten or a dozen days.

8251. They might all have come out of the same cargo?—They might have received the infection from that.

8252. They might have come in the same ship?—Yes. The cattle plague, when it broke out at the Thorpe Hall pastures, broke out almost simultaneously in various parts of Yorkshire, particularly down at Tadcaster and York, where the cattle were that were removed out of our market. At that time there were very large cattle shows, many markets were overstocked, and there was a great number of cattle turned out unsold.

8253. Among those great shows of cattle there were certain Foreign cattle, and you saw at least four of them that you conceived had this unknown disease upon them?—Yes. The cases that I saw before I saw this Foreign animal were English cattle.

8254. Where had they got the disease from?—I have no doubt they had got it by the transit of foreign cattle in the various districts.

8255. How long will the disease take to incubate do you think. Suppose a foreign beast is brought from Holland and turned into a meadow here?—I should suppose that if an infected animal, whether an English or a Foreign animal, was put near others, half the stock would be infected within a few hours. It might not show itself possibly for from eight to ten days.

8256. It would take from 10 to 14 days before it would exhibit itself as palpable disease in the English cattle?—Yes.

8257. If this animal that was brought to Leeds took the infection just at the time when it was brought to Leeds, others from the same cargo might have received the infection from the animals that were taken to York and to Tadcaster, so that you might have had simultaneously animals at York, Tadcaster, and Thorpe Hall pastures all diseased from the same cause?—Yes. This animal became diseased on a Monday evening. On the Wednesday evening it was followed by two English ones, and on the day following it was followed by a Foreign animal, and in quick succession animals arrived from various parts of the district round about.

8258. (*Chairman.*) Did you give evidence before the Cattle Plague Commission?—Yes.

8259. Is it printed in their report?—Yes. My opinion is that the disease did not break out spontaneously in these pastures, but that it was taken there by infection, and I ground that opinion upon the fact that in the same manner it has been taken to other parts of the West Riding of Yorkshire. As to the supply of water to these pastures, there is a continuous supply of good, fresh, wholesome water for the cattle during the whole of the year. It was never known to be otherwise. I believe that the cattle in these pastures will take the good, wholesome water before they will go to the river.

8260. (*Professor Way.*) You do not deny that the river is in a bad state?—No.

8261. You do not deny that a healthy condition of the atmosphere and the water is more likely to be beneficial to the cattle than an unhealthy condition of them?—Certainly not. I believe that parties who are well versed in the habits of animals will agree with me that animals, if they can get pure water, will not go and take impure water. We cannot get a cow to drink out of a greasy bucket if we put pure water in.

8262. Will not cattle drink water that we should call dirty in a ditch or pond?—I think they will take pure water first. During my experience as meat inspector, twice or three times in 1861 and 1863, a disease broke out amongst the animals in these pastures called, by Professor Gamgee, splenic apoplexy. We call it the melt complaint, but it is a fearful disease. A very large number of animals have died of that disease. It is peculiar to these pastures, and to pastures further down the river called the Brotherton Marshes. In 1861 and 1863 a very large number of cattle died. I saw five lying dead in these pastures one morning.

8263. To what do you attribute that?—These

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pastures at certain seasons get overflowed from the river Aire, and when the grass becomes rich, the animals then become liable to this disease. It is the flush of the grass in the pastures.

8264. Does it arise from the cattle thriving too rapidly upon it?—Yes.

8265. You stated that the cattle plague broke out in these pastures of Thorpe Hall, at Tadcaster, and at York, at the same time?—Yes.

8266. Had you animals from all those places?—Yes.

8267. Was the cattle plague equally severe at all of those three places?—I believe it was equally or rather more severe down at Tadcaster, York, and the neighbourhood of Wetherby, than at Leeds.

8268. On what river is Tadcaster situated?—On the Wharfe.

8269. Are there many large towns above Tadcaster that pollute the river Wharfe?—I think not.

8270. Tadcaster is only a few miles below Arthington, I believe?—It is about 10 miles.

8271. From Arthington the Leeds people at present obtain their water supply, do they not?—Yes.

8272. Are there any considerable towns between Arthington and Tadcaster?—None.

8273. Therefore, the water at Tadcaster would be nearly as pure as the water at Arthington?—Yes, and perhaps purer.

8274. Were the cattle at Tadcaster that took the disease grazing upon the pastures by the side of the river?—Most of the grazing pastures lie upon the river side, but the farmers unfortunately had got their stores of cattle in just at that time, and that was the reason why there was a very large quantity in this district.

8275. From the crowding of the animals together?—Yes, there was a greater number than usual.

8276. Was that the case also in the Thorpe Hall pastures?—No, it was not.

8277. At York how was it?—I should attribute it there to the same cause as in the Tadcaster district.

8278. Was there a great increase in the number of stock upon the meadows at York at that time?—I believe there was.

8279. You say that you believe the disease was quite as bad at Tadcaster and at York as in the Thorpe Hall pastures?—It was worse. I wish to point out that in all probability this was an infected animal before it went to Thorpe Hall pastures.

8280. Are you inspector for Leeds now?—I am cattle plague inspector. I resigned the office of meat inspector in September.

8281. What became of the carcase of that diseased animal?—It was destroyed.

8282. Have you ever known the carcases of diseased animals sold for human food?—Yes.

8283. Any that have been diseased with the cattle plague and then slaughtered?—Yes, many a score.

8284. Animals that have been diseased when slaughtered?—Yes.

8285. The meat has been sold for human food, has it?—Yes. I am aware that a number of animals which formed part of the "Revel" cargo were brought to this town and exposed for sale in the cattle market.

8286. Have you known any diseased meat to be sold in this district—cattle that have died of milk fever, dropped calves, or measled pigs?—Yes.

8287. Is it sold now if they can circumvent the inspector?—They will sell it if they are not found out.

8288. There is a variety of diseased meat, but as to the worse class of it, in what form does that come into public use? I suppose it is too bad to be sold in joints, do they make it into sausages, and put it into soup?—The public do not thoroughly understand the diseased meat question; a cow affected with milk fever is generally a fat cow, one that has been very well fed during the time of calving. The beef of a milk-fever cow can be sold anywhere, although if it had not been killed a few hours before it would have died.

8289. Therefore, you think that you need not prohibit the sale of a beast in that condition?—I have done so with many a score.

8290. Do you think it would not be injurious if it was eaten?—I believe it would, if the animal had been suffering from certain diseases, particularly fever diseases, such as the disease I have mentioned, which has been prevalent in the Thorpe Hall pastures, namely, splenic apoplexy. In milk fever the animals, generally speaking, are in very good condition and can be exposed for sale with impunity, and it requires a very experienced and well-practised eye to detect it.

8291. You do not mean to say that it should be sold?—Certainly not. I hold that the flesh of animals diseased, palpably so, particularly diseased with fever—no matter what condition the animal is in as to fatness or appearance—is not fit to be eaten and ought to be condemned.

8292. Would you say, as a rule, that meat inspection should be carried out far more generally than it has been?—Yes. I may state that I have given evidence three times upon this subject, twice before a Committee of the House of Commons, and once before the Cattle Plague Commissioners. With regard to the inspection in the borough of Leeds, there is one inspector for the whole borough round about Leeds—for 20 miles round; and the farmers, cattle dealers, and owners of stock, when they find that an animal is diseased, kill it, and off it comes to Leeds or Bradford or Halifax. Leeds being bounded on three sides by agricultural districts, we get all their diseased animals. I may say that while I was meat inspector for eight years and eight months I condemned 3,600 diseased carcases.

8293. Were they destroyed?—Yes, they were all destroyed.

8294. (*Mr. Harrison.*) Have there been cases of cattle that were affected with pleuro-pneumonia?—Yes, there have been many hundreds.

8295. It is the custom, I believe, when pleuro-pneumonia gets among healthy stock frequently to kill a great number of them?—Yes, as it would go through all of them unless they were killed.

8296. In that case there might be very different degrees of disease among the animals?—Yes.

8297. Is it easy to detect the disease?—Yes, it is to a certain extent. You can always detect it in the lungs if taken in the very early stages; but you cannot detect it always in the carcase.

8298. Have you had in the district many sheep with the rot, or flukes in the liver?—We have had few rotten sheep for these many years.

8299. Does the disease affect the flesh of the animals?—Yes, it does very much, it produces a whitened appearance on the fat, and the lean is soft and watery.

8300. That, I presume, you would prevent from being sold?—Yes, always.

8301. A great variety of animals are affected with that disease, I believe?—Yes. With regard to flukes in the liver, there are very few sheep in a healthy condition which have not some of them, and we cannot interfere with them.

8302. It is a question of degree; when the number is excessive the disease is serious?—Yes, when the animal is palpably diseased.

8303. I believe that in some cases you might have a large number of fat sheep that had more or less flukes in the liver?—Yes, there are very few ewe sheep which have not flukes more or less in their livers. I understand that they are the causes of what is called the rot in sheep, although the animals may be in a very healthy state and in a thriving condition for a length of time.

8304. Have there been many cases of pigs diseased with measles?—Not so many, not of late years; there are cases occasionally, but only occasionally, and the reason of that is that they undergo a very strict inspection. It is mainly Irish pigs that have the measles, and they undergo a very strict scrutiny at Liverpool before they go further.

8305. Can they detect the disease in an animal while alive?—Pig dealers going down to Liverpool market go and buy 40 or 50 pigs; the pigs are then submitted to experienced judges, and they get 2*d.* each for examining them. They seize each pig and look at the tongue. They can tell a measly pig by looking at the tongue, consequently very few measled pigs make their way here, there may be one occasionally.

8306. Do you know whether the meat of a measled pig when eaten is very mischievous?—I should say that it would be. I always condemn it when I find it.

8307. You say that you know the condition of the river and that it is bad; are there bad smells emanating from the Sheepscar brook?—Yes, very bad smells indeed.

8308. Is it ever to such an extent as to affect the meat which is slaughtered in the town?—I do not think that the smell would come that way.

8309. Are there public slaughter-houses?—The slaughter-houses are not near that beck.

8310. Are there public slaughter-houses?—There are no public slaughter-houses; they are all private ones.

8311. What becomes of the refuse from the slaughter-houses?—It goes down the sewer; the blood and the offal and the manure are taken away.

8312. But the washing from the slaughter-houses, and so on, goes into the sewer?—Yes.

8313. When you were inspector did you inspect the slaughter-houses?—Yes.

8314. Did you find that matter attended to?—Yes, I had no trouble with the butchers. I had some trouble at the commencement, but I soon got them into a cleanly way.

The witness withdrew.

Mr. Robert Garside (Leeds) examined.

Mr. R. Garside.

8315. (*Mr. Harrison.*) I believe that you are an alderman of the borough of Leeds?—I am.

8316. Have you been resident in Leeds for a number of years?—Above 50 years.

8317. How long have you been a member of the council?—Nine years.

8318. Then you are well acquainted with Leeds and its neighbourhood?—Yes.

8319. What was the condition of the river in your earlier days?—The river in my earlier days was much purer than it is at the present time; indeed, I have often gone to fish at a place in the upper part of the town, and there were quantities of fish at that time in it, some 30 years ago or perhaps 35 years.

8320. What was the condition of the Sheepscar Beck at that time?—The Sheepscar Beck since I can remember it was the place from which the population at that end of the town fetched almost all their water for domestic purposes. I cannot say that it was drunk, but it was a comparatively pure stream at that time.

8321. It was used for all purposes, except for drinking?—Yes.

8322. It was used for washing?—For washing, and everything of that sort.

8323. For cooking?—Yes.

8324. And for everything, except absolutely for drinking?—Yes.

8325. Then it must have been in a very different state from what it is now?—Quite so.

8326. Was the water of the Aire used in the same way at that time?—The water of the Aire was pumped up for the supply of the town in my recollection, within, I should think, 30 years, and perhaps less than that; it was pumped up from Leeds Bridge.

8327. Was that the chief water supply for the population?—Yes, with the exception of the wells.

8328. Were they numerous then?—Yes.

8329. Are they now used?—Yes, to a certain extent. We had some very fine water at Holbeck, and the same soft water exists underneath almost the whole surface at certain depths.

8330. Have you been chairman of any of the committees connected with this borough?—I have been chairman of the lodging house committee, and I have been chairman of the nuisance committee.

8331. Have you taken steps to diminish the nuisances in the borough of Leeds?—Very much so, in the last year or two.

8332. Have you seen the evidence which we have had as to the existence of nuisances at the present time?—I have not.

8333. We have had it stated to us that there are 1,000 sleeping apartments in Leeds placed over cesspools?—I believe that that is the case. I have been to see many myself.

8334. Are you still a member of the nuisance committee?—Yes.

8335. There seems some work for you to do yet?—Yes, it is one man's hard work to manage that committee.

8336. What other nuisances are there besides the cesspools and privies?—I consider that one of the greatest nuisances in Leeds is the sewers.

8337. In what way have you found them to be a nuisance?—I think that they are capital things for taking away dirty water, but they are unventilated, and are a great source of death and disease in the town of Leeds.

8338. Have you experienced cases of death distinctly arising from the unventilated condition of the sewers?—It has been the opinion of all practical men for a long time that a part of the town which we call Cavalier Hill, which is one of the highest parts next the river, has been very much affected by the exhalations.

8339. Are the inhabitants there of a better class?—They are a good class of well-to-do working men.

8340. Have they generally waterclosets in the houses?—No, but privies.

8341. How are the sewers connected with the houses in that part?—They are not always connected, but I consider that when houses are connected with sewers, unless the sewers are properly trapped it is a great injury.

8342. Are the sinks in the back kitchens in connexion with the sewers?—In some cases.

8343. Mr. Dresser mentioned this morning that in examining about the borough he found that there were exhalations from the sinks to a considerable extent?—Yes, and that will always be the case, for this reason, when a sewer is not ventilated the warmth of the kitchen or of the house will draw up the gases much faster than would otherwise be the case.

8344. That, in fact, becomes the ventilation?—Yes, a kind of syphon.

8345. That points out the necessity of the nuisance committee or the corporation taking steps for better ventilation?—Yes; I have more than once brought before our committee the desirability of ventilating the sewers, but we have not yet been able to carry it out.

8346. You have a lodging-house committee?—Yes.

8347. For how many years have you been chairman of it?—For about two years.

8348. Have you improved the condition of the lodging houses?—I believe that the lodging houses are very well conducted, and I should think that the death rate in the lodging houses is as low or lower than in any part of the borough where the poor people live.

8349. Do you know Huddersfield?—I know it, but not very well.

8350. Are you aware that there the authorities have erected a model lodging house?—I am not aware of that.

8351. They gave us evidence upon the subject, and

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it appears that they have erected a model lodging house accommodating about 90 males, about 12 married couples, and about the same number of females, and that they find it remunerative and a very great convenience to the poor people who require it, that it becomes self-supporting in the course of time, and that it is a very great advantage to the town?—We have a place of that kind in Leeds; it was got up by some of the first gentlemen in the town, and it is in active operation at the present time, and I believe that it has always been remunerative.

8352. What number of people will it accommodate?—I have been over it many times, and I should think that there are from 58 to 70 inmates in it.

8353. Is it for occasional travellers or for mechanics who work in the town?—It is for occasional poor travellers if they choose to go there.

8354. At Huddersfield they have a separate part of the building set apart for the mechanics who pay a small rate per night and who have the accommodation of a sitting-room and a library, which appears to be generally filled and appropriated?—In Leeds the lodging house is very well conducted.

8355. Do you find an improvement in the health of the occupiers of these lodging houses in consequence of your inspection?—Certainly; we see that the bedding is washed, and that the house is whitewashed, and whether there is any case of illness.

8356. Are you engaged in any business in Leeds?—I am an ironmaster, and a colliery owner.

8357. Where are your collieries situated?—About a mile and a half outside Leeds.

8358. In which direction?—In York Road.

8359. Are they within the area of the Sheepscar Beck, or the beck adjoining?—No, they are upon higher lands.

8360. Are they deep mines?—The deepest is about 110 or 115 yards.

8361. Have you much water to pump from them?—We have a 13-inch pump working night and day, Sundays included; we have a 4-feet stroke, and I should think that we generally run about 13 or 14 strokes a minute.

8362. What is the quality of that water?—I should think that it is the purest water in the neighbourhood of Leeds.

8363. How many years have you been working there?—We have been pumping that water several years now, and I do not see that there is any diminution of it, it keeps permanent.

8364. What becomes of that water?—We pump it into the nearest gutter, and away it goes into the river.

8365. Is it a peculiarly soft water?—It is a very soft water.

8366. Would it not be of use to the dyers or other manufacturers in Leeds?—I should think that it would be very valuable for any manufacturing purposes.

8367. Is it ever putrid?—I cannot state that.

8368. Do you know the seam of coal which you are working?—The seam of coal which we are working is what we call the Lowmoor and the Bowling Beds, it runs over from Bradford into this district.

8369. Are you working any beds besides those?—Yes, we are working some about three miles from Leeds, called the Beeston Beds.

8370. Have you much water there?—Not more than half as much as in the other place.

8371. What is the size of your pumps there?—15 inches in diameter and four feet six stroke. We run as slowly as we possibly can, and we have to keep standing. I should think that we do not run more than five strokes on the average of the day through for the 24 hours.

8372. It was mentioned to us yesterday that the Lowmoor Company were pumping to a considerable extent at Beeston, so as to affect the wells in Leeds; have you any knowledge as to that?—No; they are down to the same beds as we are, namely, the Bowling and the Lowmoor beds.

8373. They are colliery owners as well as iron manufacturers?—Yes.

8374. Then that water would be pumped from their coal pit?—Yes.

8375. What is the quality of the water which you get at Beeston?—I have heard it said that it is very good, but I have no practical knowledge of it myself.

8376. Is iron water pumped from any of the mines here?—No; an immense quantity of water is pumped from mines in our immediate neighbourood, but I think that it is altogether of a very good quality.

8377. As an iron manufacturer, do you throw any refuse of any kind into the river which pollutes it?—None of any sort.

8378. How many men do you employ at your manufactory?—I should think that we have been employing from 500 to 700 men and lads.

8379. What becomes of the sewage matter which you must have upon your premises from that number of persons?—I do not know that we have any particular arrangement.

8380. You have no special provision made for the men?—No.

8381. You have no waterclosets or anything of that sort upon the premises?—We have not.

8382. Must it not be awkward for them sometimes?—I do not know; they go among the dross-heaps in the field.

8383. Are your works situated near the river?—No, they are a mile or a mile and a half from the river.

8384. Then you have a large quantity of refuse?—We have large heaps of refuse.

8385. And they do not come at all within the scope of the river?—Certainly not.

8386. We have found in some cases that the slag is thrown into the river; at Keighley, for instance, large quantities are thrown into the river?—But ours is valuable as a road material, we sell what we make.

8387. I presume that the weight and quality of that slag is such that if it were thrown into the river it would settle down in some part of it below the point where it was thrown in, and would have to be removed or the bed of the river would rise?—Certainly. We make the dross into solid square heaps, a little above the town, and it is as hard as stone.

8388. And slag from other processes, namely, cinders, would settle down in the river, would it not?—Yes, if it went into the river.

8389. It must either raise the bed and do injury or it must be removed?—Certainly.

8390. Therefore, do you think it would be right to prevent manufacturers throwing anything of that sort into the river?—Certainly.

8391. (*Professor Way.*) Are these coal pits which are near the town of Leeds extensive?—They are.

8392. Do you anticipate that they will wear out in a few years?—Just close to Leeds they will no doubt be worked out in 15 or 20 years.

8393. But so long as those beds or similar beds last will the pumping of that quantity of water which you speak of be necessary?—Yes, we cannot keep our works going without it.

8394. Supposing that that water were necessary for any practical use, could you rely upon a supply of it for the next 20 years?—I think so, from our pits.

8395. I suppose that there would be a limit to it?—No, not unless some other persons sank down in a deeper place, and took the water from us.

8396. At present the water is pumped out merely because the coal workings cannot be carried on without that being done?—Just so.

8397. But supposing the beds to be worked out, it would be necessary that the water should bear the expense of pumping?—Certainly.

8398. Do you know whether that water is at all alkaline?—I do not.

8399. Is it of the kind of which they speak here as spa water?—It is not spa water; it is very soft without the spa.

8400. It is soft without being alkaline?—Yes.

8401. It is in all probability a good water for brewing?—I should think that it was good for anything.

8402. (*Mr. Harrison.*) As chairman of the nuisance committee, have you taken any steps to prevent the smoke which is discharged into the air at Leeds?—Yes, we have an inspector continually employed, and when required he has assistance from the police.

8403. Have you found that you have been able to diminish the smoke nuisance?—I believe that if we had not an inspector we should be a great deal worse than we now are.

8404. And that is bad enough occasionally, is it not?—Yes, perhaps it may be; but I think that we are a great deal better than we were.

8405. Have you not obtained further powers in a late Act?—Yes.

8406. Which will enable you further to diminish the nuisance?—Yes; we have now the full powers which are required to diminish the quantity of smoke which is made in Leeds.

8407. Do you anticipate that you will be able to diminish the smoke from your own ironworks?—In some portions we shall, but not in all. We burn an immense quantity of cinders for our iron, and we cannot make any difference with them; no plan can be adopted to do away with the smoke there entirely.

8408. Do you smelt?—Yes.

8409. Do you roll?—No, we only smelt; we are only pig iron makers.

8410. Have any means been proposed for diminishing the nuisance from your smelting works?—There has been some attempt made, but I do not think that it has been at all successful.

8411. Does not a large proportion of the smoke of Leeds come from its iron works?—I believe so.

8412. Have you seen the contrivance which Mr. Kitson is erecting for his steel works?—Yes.

8413. Have you seen that in operation anywhere?—No.

8414. If that was successful it would be a great benefit, and would considerably diminish the quantity of smoke?—I should say that it would.

8415. He anticipates that it will at the same time effect a saving in fuel to him?—If that is the case there will be no difficulty in getting it adopted.

8416. Have you had experience with large boiler chimnies?—Yes.

8417. Have you been able to diminish to any extent the quantity of smoke arising from them?—My own impression is that it depends more upon the stoker than upon anybody else whether smoke is made or not. If you give the best machinery it cannot be done if it is not properly carried out.

8418. At the same time if a stoker fired well there would be very little smoke?—Very little.

8419. Seeing that that is the case (and it is acknowledged on all hands that it is so), should you think that there would be any hardship in making it compulsory that the smoke should not be emitted from the chimnies?—I think that there is a defect in our Act. Whenever smoke is made a penalty is thrown upon the masters. I think that that ought to be varied, and that a good deal of the blame should be thrown upon the workmen; that would have the best effect of anything I know.

8420. Does not the prevention of smoke depend in a great measure upon the masters supplying a sufficient number of hands to fire the boilers steadily?—Every master would do so. I do not think that there would be any difficulty about that.

8421. You think that the question of expense in supplying a sufficient number of hands to fire is not the difficulty?—I think not; I think that it generally arises from carelessness in the stoker.

8422. If you put the master to extra expense, you do not consider that that would be an objection against preventing smoke?—I think not.

8423. It has been stated to us as an objection, that it would put the masters to a greatly increased expense to be obliged to supply hands for regular stoking?—I think that the expense would be very trivial; most men in Leeds have not more than two boilers to attend to, and if men would fire carefully and systematically, they might prevent a great deal of smoke.

8424. (*Professor Way.*) I suppose that you might fine the men for not stoking carefully, and might pay them a little extra if they did stoke carefully?—Certainly. We pay good wages to all men of that class.

8425. (*Mr. Harrison.*) Do you think that the present condition of the Aire and of the Sheepscar Beck affects the manufacturers of Leeds to any serious and mischievous extent?—In the way of health?

8426. Not in the way of health, but as interfering with their trade?—I do not see how the becks can be improved, for this reason—manufactories are continually increasing, and more impurities must be continually put into the becks. I think that the best thing which we could do to the becks would be to give them a hard circular bottom, and not the present surface for mud and so on.

8427. You have an Act of Parliament for carrying that out, have you not?—Yes.

8428. And is it the intention of the corporation to do so?—I believe that it is.

8429. (*Professor Way.*) In that way you would improve the condition of the becks; but would you improve the river by it?—You could not put a bottom to the river.

8430. The river would remain as foul as it is?—Yes. The river in a very dry time becomes very foul about Leeds. Looking at the river in a dry time you will see patches rise to the top, perhaps of the size of the crown of a man's hat. I have continually seen gas bubbling up all the day through; that is just in the town.

8431. (*Mr. Harrison.*) Do you mean below the outfall of the sewer?—No.

8432. Is there any sewage now discharged into the river opposite to the town?—No, I believe not; it all goes below.

8433. But you receive the sewage of all the towns above you; Bradford, and other towns?—Certainly we do.

8434. Then do you consider that you are feeling the ill effects in the borough of Leeds of the sewage of other towns being sent down to you?—Yes; the river being so impure is sure to affect the air of the town and also the health of the people.

8435. Therefore as a town you are interested in the river being made pure?—Certainly, as far as we possibly can.

8436. Therefore one would fancy that the manufacturers in Leeds, and the inhabitants generally, would be glad of any measure which should be carried out preventing the pollution of the river throughout the whole district?—Yes, if it could be carried out without injury to trade. As a town, we must, as far as possible, protect the trade of the town. There are always sure to be impurities where you have large trades, you cannot get out of that.

8437. But you may to some extent prevent those impurities being carried into the river?—If you put that refuse into the sewers it would run into the river all the same; you would only remove it below Leeds.

8438. Do you consider that it would be a great advantage to your borough if you could restore the river to the condition in which it was when you remember that you could fish there?—If we did that we should destroy the trade.

8439. (*Professor Way.*) You mean to say that any proposition as to the purification of the river must keep the trade in the foreground as the chief object?—There is not the least doubt of it.

8440. The trade is the life of the town?—It is.

8441. And the other thing is the comfort of it?—Yes.

8442. But at the same time you are not in a position to say positively that no plans or combination of plans would, without serious or real injury to trade,

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effect a very considerable purification of the river?—I do not know of anything.

8443. But you are not in a position to say that it is impossible?—Certainly not.

8444. For instance, you are not in a position to say that the diverting of the sewage of the towns from the river, and the application of it in irrigating land, is impossible?—It is not impossible.

8445. And of course to that extent the river might be rendered purer?—The question arises at once, Would it pay?

8446. You mean would it pay its expenses?—Yes.

8447. The question is as to whether the thing is desirable and how much it is worth, and whether it is practicable?—Yes.

8448. (*Mr. Harrison.*) We have had it in evidence here that your corporation at present pay about 4,000*l.* a year for the removal of cesspit ashes, and so forth, from the town?—We pay about 3,000*l.* for the ashes.

8449. The figures given were 3,800*l.*, and Alderman Carter said, that with other expenses, including the officers, the sum mounted up to 4000*l.* a year?—Yes, I should say that it would if you reckon the officers in.

8450. And Mr. Filliter stated to us that pumping the sewage 25 feet so as to send it on to land below by gravitation would not cost 3,000*l.* a year, so that if you had the watercloset system carried out throughout the town and that expense of 4,000*l.* a year was done away with, you might pump all your sewage without any expense to the borough beyond that to which you now go?—You could not get out of the 4,000*l.* expense, that is, for the removal of ashes and night-soil out of the borough of Leeds. We do not now allow anything of that sort to be deposited within the town, when we did so it cost the town a great deal less money.

8451. But you would get rid of the night-soil if it was carried into the sewers?—Certainly.

8452. There would only remain the ashes?—Just so.

8453. And they would not be such a source of nuisance?—They would not, but still the expense would not be lessened, but rather the reverse.

8454. Would it fall upon the borough to remove the ashes if the sewage matter was separated from them?—The town would have to remove them, there is not a question of it. No plan can be adopted of keeping the town at all cleanly unless the corporation takes into its own hands the removal of such refuse.

8455. Is there any other point which you wish to mention?—I will just say, as chairman of the nuisance committee, that if we could have one large slaughter-house establishment for the whole borough and could do away with the many slaughter-houses which we have spread over the town in every direction, it would be a great source of benefit to the health of the people, and it would do more than that; at the present time, with a slaughter-house to every butcher's shop, it is impossible to inspect the meat properly. If we had a registered slaughter-house for the whole borough, where every beast which was killed could be inspected, I believe that the health of the town would be very much benefited.

8456. Would you have that slaughter-house beyond the limits of the borough?—I would have it somewhere outside away from the inhabitants.

8457. Where all the refuse might easily be carried away into the main sewer?—In that case the town would claim all the refuse. They would allow people to kill for so much a beast and they would claim all the refuse and it would be cleared away continuously as it was made.

8458. Have you powers for carrying out that object?—Yes, and it has been more than once before our committee.

8459. And as chairman of the nuisance committee you conceive that it would be a very great benefit to the town if you could carry it out?—Yes.

8460. What are the obstacles in the way of its being carried out?—The expense partly.

8461. Should you have power to stop all the private slaughter-houses in that case?—Yes, we should do so.

8462. (*Professor Way.*) I suppose that that would be a great comfort to the people who use the streets?—Yes.

8463. The slaughter-house might be so arranged that very few of the cattle would come through the town?—Yes.

The witness withdrew.

Mr. J. Reffitt.

Mr. James Reffitt (Leeds) examined.

8464. (*Mr. Harrison.*) Are you a resident in Leeds?—Yes.

8465. In what part of it?—I reside at Springfield Mount. I have dyeworks on the Kirkstall Road.

8466. Near Joppa?—They are the next to Mr. Alderman George's. It is a little nearer Leeds than Joppa.

8467. And close upon the banks of the Aire?—Yes.

8468. How many hands have you employed upon your works?—About 240 or 250.

8469. What do you dye?—Stuff goods that are made in Bradford.

8470. Do they send goods from Bradford to you to dye?—We fetch them.

8471. Are they finished here?—Yes, we fetch them as they come out of the loom, and return them finished.

8472. What quantity of water do you use per day in your different dyeing processes?—I should think that we pump from 400,000 to 500,000 gallons in a day.

8473. Where do you pump it from?—Partially from the river and partially from a well which we have.

8474. What proportion do you obtain from the river and what proportion from the well?—That which we get from the well is a very small proportion compared with what we get out of the river.

8475. How much do you pump from the well?—Perhaps 1,000 gallons a day.

8476. Is it soft water from the well?—Yes, moderately soft.

8477. From what depth do you pump it?—From, perhaps, 15 or 20 yards.

8478. Have you a bore-hole below that?—No.

8479. For what purpose do you use that water?—For what we call light colours and stoving.

8480. What is stoving?—Stoving white. Pieces are made as white as this paper. It is a very old process—scouring and stoving.

8481. And the water from the river you use for dyeing darker colours?—Yes, and very nearly all colours.

8482. Do you use the river water for cleansing the dye from the cloth afterwards?—Yes.

8483. For all the colours?—All but the stoved whites.

8484. And for that purpose you use the well water?—Entirely.

8485. Is yours a very old established concern?—Yes; it is, I should think, 50 years since the works were first erected.

8486. How do you account for the Bradford people sending their goods down here to be dyed?—Nearly all the stuff merchants used to be in Leeds; as Bradford increased in manufactures, most of the stuff merchants went from Leeds to Bradford. There are only a very few stuff merchants left in Leeds now. The merchants buy their goods of the manufacturers; they used to have to go to Bradford to buy the goods after they were just woven and ready to be given out to the dyers to dye, and then they used to send them from Leeds to the various districts up and down the country. They continued to do that till about 15 years ago

when many of them gave up the warehouses here and built or took other warehouses in Bradford.

8487. And now I believe they dye to a considerable extent in Bradford itself?—There are not more dyers in Bradford than there were.

8488. But they dye to a great extent in Bradford, do they not, the beck looks like it?—I do not think that there has been any increase in the number of dyers in Bradford in the last 20 or 25 years.

8489. Has there been an increase in the number of dyers in Leeds?—No, I think that there has been rather a decrease, but the works are made larger.

8490. Is there as large a quantity of goods dyed in Leeds as there used to be?—Yes quite. I should say that nearly as many goods of that particular kind called the Bradford make are dyed in Leeds as are dyed by the Bradford dyers.

8491. What proportion of your 500,000 gallons of water do you use in your dyeing kettles?—Perhaps, from 40,000 to 50,000 gallons.

8492. That is actually dye water?—Yes.

8493. Have you steam power on the premises?—Yes.

8494. Do you use any large quantity of water for steam purposes?—Yes, for the boilers.

8495. What do you use?—We have seven 40-horse boilers.

8496. Working how many hours a day?—From 6 o'clock to 8 and 9 o'clock, and sometimes from 6 o'clock to 4 o'clock, according to the state of trade.

8497. What quantity of water do you reckon that you use for those boilers daily?—I do not know. When they are once filled of course they merely require keeping up, to maintain the steam. I should think that perhaps 1,000 gallons a day would go a long way.

8498. What quantity of water do you use for condensing?—The steam which we use is principally for heating the dye vats.

8499. What horse power have you at work?—We have a 30-horse engine and a 20-horse, and a 12-horse and a 5-horse.

8500. What quantity of water do you use in cleaning the cloth after it is dyed?—We use a considerable quantity. I should think, perhaps, from 200,000 to 300,000 gallons in a day.

8501. What do you use for cleansing the cloth?—Principally fullers earth and clean water.

8502. Do you use urine or soap to any extent?—No, very little. We use a little soap, but not much.

8503. What quantity of fullers earth do you use daily?—Perhaps two or three hundredweight, only a small quantity.

8504. What number of pieces do you dye per day?—About 1,000 pieces per day.

8505. Of about what weight are those pieces?—They will weigh from 8 up to 16 lbs. apiece.

8506. Averaging about what?—Averaging about 9 or 10 lbs. I should think.

8507. What becomes of the refuse water from the dyeworks?—About five or six years ago we adopted a method of making a considerable portion of our dyewoods into decoctions; therefore we use the liquor and the solid part is carted away out of the works.

8508. What becomes of it?—Some of the men who make manure to sell to the farmers fetch it. They mix it, I suppose, with the town manure. We are very glad to get rid of it and they seem very glad to fetch it. We make no charge for it.

8509. Is that the dyewood?—It is spent dyewood. Spent sumach and spent divi-divi, an article like sumach, which the tanners use.

8510. What weight may that be per day?—I should think that it will average two tons per day.

8511. Do you rasp the wood or is it in chips?—For making the decoctions we have it chipped, and when we use it in the dye vessel it is rasped and is of about the same substance as sawdust.

8512. What becomes of the liquid refuse?—The dye liquor is turned into the sewer, which eventually runs into the river.

8513. Have you ever turned your attention to cleansing that water before sending it into the river?—No. I should say that it would be very difficult to do that.

8514. We have had it in evidence here that some dyers purify the water before they use it for dyeing?—Yes; I saw that that had been named by my neighbour Mr. George. Of course I did not know what process he had of cleansing it, but I thought that it would be a very difficult matter, because I know that there are parties who have been very much put about for water in a dry time who, after using the water, have returned it into reservoirs. One place I have in my mind at present.

8515. Where is that?—At the Shelf Dyeworks near Halifax.

8516. Who are the dyers there?—Those works have been in several hands. Butterworths and Lords and others. The mills are not occupied at present. It has seemed to be a very unfortunate place. Several parties have had it, and all who have had it yet have failed.

8517. What process did the owners adopt for purification?—They had a large reservoir to return the water into from the washing machines and the dyeing vessels, and of course it was allowed to remain to settle. The water might perhaps do again for some purposes, in cleansing dark colours. But they only treated the water so because they were without any other resource. If they had had fresh water to have cleansed the goods with they would have preferred it.

8518. Did they take any other steps besides simply having settling tanks?—I am not aware that they did.

8519. What is done with the ashes and refuse from your engines?—We take it all away.

8520. None of it goes into the river?—None of it goes into the river.

8521. Were you here this morning when Mr. Holroyd gave his evidence?—No.

8522. Do you consider that the situation of Messrs. Holroyd's dyeworks at the junction of the Gipton Beck with the Sheepscar Beck gives them a great advantage over other dyers in pure water?—They have this advantage, they have some very nice water which comes out of the country down to a reservoir near the works. I know the locality very well.

8523. Should you think that it would be any considerable benefit to yourself as a dyer if the condition of the Aire was improved, if the water was purified?—Yes, we should be very glad to have it purer than it is, though we are nearly at the top of the stream. There has not been much to complain of in it until the last few years when tanneries have been created above us, and they have fouled the stream considerably.

8524. And they have affected your dyeing processes?—Yes. Tanning is very bad because tanners are apt to use a large amount of sumach, or divi-divi, and gambia, and we have to use the same articles for dyeing purposes. It does not actually give a colour but it prepares the cotton to receive the colour. It acts as a sort of mordant. We often get it when we do not want it, though we very often have to use the same materials in our dyeing process.

8525. Considering that that is the case, and that you really feel the disadvantage of having the river so polluted, would you as a dyer object to being put to some expense in purifying the water which you use yourself if others were obliged to do the same?—If the expense was a moderate one we should not care, but as we have to compete with the Bradford dyers, and we have to cart pieces backwards and forwards, which is an additional expense already, and if the expense was to be very heavy it would amount to this, that we should have to remove the works to Bradford or the neighbourhood, or some locality near. If we were put to a serious expense in having the water made purer than it is it might be a very serious thing.

8526. What should you consider a serious expense?—I saw that Mr. George had named 100*l.* a-year.

8527. As a sum which he would not at all object to?—That is rather a serious sum when rents and

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rates have all to be considered, because unfortunately having the dyeworks so near the town we have much higher rates to pay than they have out of the borough.

8528. (*Professor Way.*) Would not you take your own share of the expense of purifying the river and keep your own impurities out if others were compelled to do the same?—Certainly.

8529. There would be some return to you?—If the sum was moderate I should not care, but 100*l.* a-year for that, and 100*l.* a-year for something else, adds up.

8530. The question of 100*l.* a-year is a mere way of stating the thing in order to see what is meant by large sums, there is no plan founded upon 100*l.* a year? — We have always been able, up to the present time, to carry on our works without any additional expense, because we have had the good fortune to be pretty high up the stream at starting. The Joppa works are just above us, but we manage very well as regards them, for we had a large trough wood spout or conduit to convey all the refuse water from Mr. Botterill's dyeworks—that is above Joppa; the large spout commenced there, and then it took the Joppa works and Mr. George's, and then my own works and Mr. Walker's below, and so on. We conveyed the refuse down below our works, and of course we had the benefit of having the water coming down pretty clean and pure.

8531. Anybody who had works at the outside of your spout would have the water in all its filth?—They would have it in any case. Where the spout ends there is a break of perhaps the length of two fields before you have any other works. We have the pipes arranged so that they are within about two yards of the other side of the river where we draw the water from, on purpose to have it as clean as we can get it, and it is only for a month or two in the year that we have been put to any inconvenience. This year is perhaps the best year that I ever knew, on account of our having had so much rain. The water in the river has kept very pure, or, at least, so that we can carry on all our works with advantage.

8532. Those two or three months of inconvenience which you speak of, I suppose, are a positive money loss, are they not—they stop your works for a time?—The works are not actually stopped.

8533. Are you reduced at those times to make inferior goods?—We perhaps cannot do all the same kind of work which we otherwise should do.

8534. Is it not the case that the words "inconvenience and trouble" in the case of manufacturers mean loss of money?—Yes.

8535. (*Mr. Harrison.*) If you could not dye the same kind of goods, those who want them would go to another dyer?—Just so.

8536. And it is not very easy to get trade back again, is it? — We have never been put into that position yet. In a very dry season we have found that less water comes down the river than used to do. I have been at these works myself above 30 years, and when I was first there the water was beautiful and clean, in fact, at our works it is about the deepest part in all the river; it will be three yards deep almost at any time.

8537. (*Professor Way.*) You spoke of the increase of Leeds, and I understood you to say that the dyeing manufacturers had not decreased, but that they were much the same as they were some 12 or 15 years ago? There are rather fewer stuff dyers, that is to say, fewer dyers who dye Bradford goods, but there may be quite as many dyers altogether; there are some dyers who dye wool only, and there are some dyers who dye cloth only, while others, who are called stuff dyers, dye Bradford stuffs.

8538. Taking the whole money invested in dyeworks in this place, has the trade largely increased?—It has increased, I have no doubt, because though there may not be any more works in number they are larger works, and, of course, the capital of each would increase in proportion.

8539. If Leeds, 15 years ago, were a place in which the large trade was the dyeing of stuff and other goods, would it not be reasonable to expect that that trade would have increased with the general population, or in some relation to it, if some cause had not existed to interfere with the increase of the trade?—Do you mean in reference to dyeing only, or to all the trades?

8540. I mean in reference to dyeing. If Leeds was the head-quarters of a particular trade for which it was noted, and if its population has been found to increase very largely, would you not have anticipated that that trade would have increased with the population?—I should say that it has increased, the works have been made larger.

8541. You do not think that the dyeing done here has been comparatively stationary, taking into account the population?—No, I am certain that it has increased.

8542. You think that as the water has got worse and worse, still the dyeing has gone on in the same ratio?—Yes, it certainly has not decreased.

8543. Do you think that if the river becomes more polluted in proportion to the increase of population at the present rate, you will be able 10 or 15 years hence to use it for dyeing purposes?—It might be used for some purposes, but where delicate colours were wanted it would not do. We have found that the Bradford canal, which has been a very black place at certain times, has been let off into the river Aire when there has been a large fresh in the river, and for a day or two we have at my works, perhaps, received as much annoyance from it as from anything; but I am happy to hear that there is a probability of that place being filled up. It is only a short canal from Shipley to Bradford, and there is some probability of its being filled up—that will be a great kindness to us at Leeds.

8544. (*Mr. Harrison.*) Have they let the water off from the canal without giving you any notice of their intention to do so?—We have never had any notice. We sometimes have had to stop our works for half a day, or a day.

8545. (*Professor Way.*) You said that you had to compete with Bradford?—Yes.

8546. I suppose that you would expect that if you were put under any kind of restrictions as regards the river, and the amount of impurity which you could throw into it, the Bradford people would be put under the same?—The Bradford people do not get their water from the river, it is collected from dams and from the waterworks, and they run their refuse sewage into the canal which I spoke of, at the end of the Bradford beck.

8547. Supposing that one part of this district was put under an embargo as to throwing impurities into the river, may we not take it for granted that the other portion would also be put under that embargo, and that, consequently, the Bradford people would have the same expense, whatever that might be, in purifying their refuse matter before they threw it into the river; no matter where they got their water, you would then be put more on a level with them?—Yes. I am an advocate for having clear water, and for having the river kept as pure as it can be kept.

8548. (*Mr. Harrison.*) Do the manufacturers of Bradford now get their water from reservoirs?—They have reservoirs of their own belonging to different dyeworks.

8549. Where do they get the water from?—I think that they get it from the land about. It is collected in small streams. There is a beck which runs near to Mr. Smith's works, and I believe that from that beck they are almost the first takers, and it is a moderately pure stream.

8550. Do any of them get water from the waterworks?—Yes, I believe that they get some from the waterworks for some particular purposes, for light colours.

8551. (*Professor Way.*) I understood Mr. George to say, not that he purified the water which he used, but that he took the river water and dealt with the impurities in it?—Yes.

8552. There is no difficulty in doing what he does

in that respect?—No; we have to add a little alum in order to purify the water as much as possible.

8553. That would not apply in the same degree to purifying the water after you have done with it?—No.

8554. (*Mr. Harrison.*) To what expense in the course of the year are you put for purifying the water for your purpose?—Very little; because we find that a little alum and a little bran will bring up all the refuse to the top, and we simply, as the vessel is heated, take off all the scum. We do so three or four times during the process of the vessel being heated up, and the water then is very clean, and you can see to the bottom of the vessel.

8555. What is the expense of that operation?—It is no expense because we should have to use alum in the process of dyeing, and therefore it is only putting it in first instead of afterwards.

8556. (*Professor Way.*) Supposing that you had pure water to begin with of course you would not use so much alum?—It might be that the water was very pure, and that we should have more alum to use owing to the peculiar nature of the water.

8557. However, the expense of it is not great?—It is not great.

8558. One can easily understand that the water which you have used, even if all the colour and all the sediment were taken out of it, would be very different from a pure river water?—It would.

8559. But when it comes to be run back into the river again it becomes extremely diluted?—Yes.

8560. Consequently if you could deal with your dye liquids so as to throw them in the shape of a clear liquid into the river, and if every manufacturer did the same, I suppose that the river, though not so pure as it was formerly, would be very much clearer than it now is?—Yes; if the sewers where our works are did not run into the river at all it would make the river very much better, but of course the refuse would only be going into the river again at Knostrop.

8561. And if all the water used by the manufacturers went into the sewers how much would remain in the river?—We have not spoken about that; we could not both send it down a conduit and let it remain in the river.

8562. (*Mr. Harrison.*) If the Leeds corporation carry out the waterworks which they propose, and bring down soft water, such as Alderman Carter spoke of yesterday, into the borough, would it answer your purpose to take that water for your dyeing processes, and what price could you afford to give for it?—The water would answer very well if the price would answer, but I am afraid that we have such a quantity to use in dyeworks that it would almost put it out of our power to give a very moderate price for it.

8563. Taking into account its pureness?—Considering everything, the quantity which we should have to use would amount to such a serious sum at the end of the year that I think scarcely anybody could compete with others in the trade who had nothing to pay for water.

8564. What do you think you could afford to give per thousand gallons?—That is a question which I have never gone into, because we have never had to buy water. I believe that something like 6*d.* to 7*d.* per thousand gallons is the price for which the Leeds Waterworks Company are now supplying water for manufacturing purposes, and if we used about 500,000 gallons a-day it would amount to a pretty considerable sum at the end of the year, almost more than we should get for all the dyeing.

8565. So that you could not stand a price like that?—We could not.

8566. If the river goes on to be continuously polluted as it has been of late years you will be obliged either to have recourse to some such source as the waterworks for a supply, or to let your dyeing go into other parts of the country?—We should have to sink another well or two, that is all that I see that we should have to do. I do not think that the water would be so bad for perhaps eight or 10 months out of the 12 but that we could use it, because when there is a middling fresh plenty of water comes down and runs away quickly, and the stream runs clear, so that under any circumstances we could use it for some months in the year for dark colours.

8567. Do you wash your cloth at all in the river itself?—No; we used to do so, but we have not done so for many years.

8568. I saw some posts in the river with some boards, was that for the purpose of washing in the river?—I think that they have been used for it, but I believe that no one is using that plan now. We had a large flat with rails round, where the men used to wash the goods, but we have ceased using it for washing for 10 years, I think, but we still keep it in use when we want to look at the pipes, or anything of that sort.

8569. Did you give it up on account of the pollution of the river?—No, but we have other washing works where we think that we can do the washing better.

8570. How many hands do you employ?—From 200 to 250.

8571. What becomes of the sewage matter from them?—We have waterclosets.

8572. And the refuse goes down the town sewer?—Yes.

8573. Do you collect the urine from your men as far as you can?—No.

8574. It all goes?—Yes.

8575. Is that the case with all your neighbours?—No. We used to have the conveniences amongst the stable manure.

8576. I think that I saw some suspicious-looking buildings over the river, outside the works near you?—What kind of buildings?

8577. Wooden buildings?—Yes.

8578. Some have privies over the river, have they not?—Some may have.

The witness withdrew.

Mr. John Arnott (Leeds) examined.

8579. (*Mr. Harrison.*) You are the manager of the New Gas Company?—Yes.

8580. When was that company established?—In 1835.

8581. In what part of the town are the works?—In Meadow Lane.

8582. Is that on the north or the south side of the river Aire?—On the south side.

8583. Is it towards the east end or the west end of the town?—I am only a stranger in the town and therefore cannot state.

8584. Will you point out the place upon the map?—(*The same was pointed out.*)

8585. Is it at the lower part of the town?—Yes.

8586. Are the works situated near the river?—No, they are at a distance from the river.

8587. What do you do with the different matters which you have as refuse from your gasworks?—The ashes are carted away, and we dispose of the lime; some is sold, and part of it is given away.

8588. To whom?—To farmers. The coke is sold to parties in the neighbourhood, to maltsters and other parties, such as founders. We have about 420 retorts going in the works, and probably we use about 33,000 tons of coal per annum.

8589. Have you read the evidence which was given to us yesterday by Mr. Smith, the engineer of the old gasworks?—Yes.

8590. Does your experience correspond in the main with the evidence which he then gave?—It is much the same.

8591. Are your works on a larger or smaller scale than his?—I think much about the same; his are divided, and ours are all in one.

8592. He said that he used 38,000 tons of coal per annum?—Yes, and we use 33,000 tons per annum.

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The amount of gas which we made last year was about 324,000,000 cubic feet.

8593. What coal do you use ?—Nearly one-half of cannel, and a considerable amount of common coking coal or gas coal ; in fact, it varies very much, there are five or six different kinds of cannel.

8594. Does any of the refuse from your works find its way into the river ?—None whatever ; all the water which we use in cooling coke is evaporated in the furnaces, and it is only the surface water in the yard which passes away into the common sewer, that is surface water such as rain water.

8595. Are your works so situated that any refuse could find its way down to Mr. Tennant's flax works ? —No, it is a long way distant.

8596. It could not possibly be from your works that he complained of gas refuse having, four or five years ago, been passed down the river to his injury ?—No, I do not think that there is anything which passes away from the works except merely surface water.

8597. Do you find at any period of the year that the lime refuse accumulates with you to any extent ?—It has done so, but we have given people opportunity to take some of it away for nothing, and a part of it is sold. We have very little stock, only about eight tons, in store. But in order to do away with any nuisance from the lime, we, in the last few months, have been preparing new apparatus to purify, and we are going to use oxide of iron. We have hundreds of tons of oxide of iron made already, and in the course of a fortnight we shall use oxide of iron instead of lime, which will do away with a great deal of the nuisance.

8598. Shall you then do away with the lime altogether ?—Mostly.

8599. (*Professor Way.*) Does not oxide of iron answer the purpose without lime ?—In some cases it does, but with some coal it will not.

8600. It is possible to use oxide of iron for purification of gas without any lime at all, or with a very small quantity of lime ?—In the Newcastle Gasworks, where I was before coming here, I for eight years used nothing else but oxide of iron.

8601. Under Hills' patent ?—Yes, and I then made the oxide of iron myself. The test for bi-sulphate by Dr. Letheby of London gave only 4½ grains.

8602. (*Mr. Harrison.*) Have you tried oxide of iron with the coal which you have here, so as to be able to answer the question whether it would be necessary to use any lime or not ?—No, but I have left provision for a very small quantity to be used for taking out the carbonic acid. The leaving in of the carbonic acid perhaps will affect the illuminating power.

8603. (*Professor Way.*) In some cases is not a little lime used with the oxide of iron itself ?—Yes.

8604. In the case of the oxide of iron you get a material which can be utilized, either for manure or by being distilled, so as to get the ammonia from it, and the sulphur, and restore it again ?—Yes. Some furnaces are prepared for extracting sulphuric acid from it.

8605. You get a more concentrated and a more valuable material, and you have not a great bulk of material to cart out into the country, as in the case of lime, at the option of the purchaser ?—Just so.

8606. So that you believe that the introduction of the oxide of iron enables you to carry on your works with less objection, and that the waste product is more marketable ?—Yes. As regards lime I could get no person to take it, but the use of the oxide of iron is no trouble to any person.

8607. Because it is a marketable commodity ?—Yes.

8608. It is taken away not only by farmers but by manufacturers ?—Yes.

8609. The tar I suppose is also taken ?—Yes.

8610. There is no probability that the demand for tar for certain colours will fall off, is there ?—The price for benzion is very low at present. Crude naphtha can hardly be sold ; it is not bringing 1*s.* a gallon, whereas, a few years ago, it was 1*s.* 6*d.* or 2*s.*

8611. To what is that owing ?—To some colours going out of fashion, and others coming in. As regards distillation of tar, pitch is selling better now than it was some years ago, but other products are less sought after.

8612. Upon the whole you do not think that gasworks are likely to be under any difficulty in future years in getting rid of their materials ?—I think not, in taking away the tar and the ammonia from the works. There is scarcely anything else which is objectionable.

8613. You do not claim any right to throw your refuse into the river ?—No ; we are more careful now in taking the products and making money out of them.

8614. (*Mr. Harrison.*) You have had considerable experience in gasworks ?—For the last 25 years. I was manager of the works in Newcastle for 19 years, and have only been here for a few months.

8615. Having had great experience, you consider that there is no hardship at all in making it peremptory upon the part of persons manufacturing gas to pass no refuse of any sort into a river or running stream ? —Certainly not.

8616. (*Professor Way.*) What do you get for ammonia water ?—It is sold by the ton. I am not sure as to what the contract price is.

8617. Do you know what quantity of sulphate of ammonia can be got out of a ton of coal ?—It varies very much.

8618. Take the average ?—Taking the average of a ton of coal, some yields about four ounces of sulphate of ammonia to the gallon, some six ounces to the gallon, and some as high as 10 ounces to the gallon.

8619. That depends very much upon the nature of the coal ?—Yes, and upon the process of washing. We are now putting up a new apparatus, by which we shall be able to take as much ammonia water from the gas as we usually get by condensation. We shall be able to get double the amount by this process.

8620. The ammonia in gas is considered very objectionable, is it not ?—Yes.

8621. Not only from causing a loss in value, but from being positively injurious to paper and leather, and things of that sort ?—Yes.

8622. So that it is one of the things which good gas should not contain in any large quantity ?—Yes ; and it is profitable to the manufacturer to take it out ; it pays very well.

8623. (*Mr. Harrison.*) Do you think that the process which you are going to adopt here might be introduced as a means of preventing a large accumulation of lime ?—Most works are adopting the new process of oxide of iron, and it is the only way that I know of doing away with complaints.

8624. Are you aware that in some cases lime is injurious to health, where persons are residing in the neighbourhood ?—Yes, in all cases.

8625. Therefore, you think that the accumulation of it to any extent ought to be prevented ?—Yes ; and it is from that cause that we are adopting this new process.

8626. (*Professor Way.*) I suppose that the reason why this process has not been adopted is on account of patent rights ?—Yes.

8627. Mr. Hills has been in constant lawsuits ?—Yes. For the last two years the general patent has been open.

8628. And you think that the obstacle to the general use of the process is removed ?—It is quite free to any person who wants to use it to do so.

8629. Therefore the use of lime in all probability will pass away ?—In fact it is to the advantage of every gasworks to substitute the oxide of iron ; it is both cheaper and better.

The witness withdrew.

Adjourned to Tuesday next at 11 o'clock, at Bradford.

LEEDS.

Mr. J. Arnott.

9 Nov. 1866.

Subsequently to the Inquiry at Leeds, the Commissioners received the following communication from the committee of the Canal Association of Great Britain:—

"Canal Association.
Aire and Canal Navigation Office,
Sir, Leeds, 31st December 1866.

I am directed by the Committee of the Canal Association of Great Britain to forward to you a copy of Resolutions passed by them at a recent meeting, and to request that you will lay them before the Royal Commission appointed to inquire into the Pollution of Rivers. The Committee are of opinion that if their recommendations were adopted, the existing law would be sufficient to remedy the evils so justly complained of.

I am, Sir, yours faithfully,
(Signed) Thomas Wilson, Hon. Sec.

The Secretary to the Royal Commission on the Pollution of Rivers,
&c. &c. &c."

"Canal Association.

At a Committee Meeting of the Canal Association (called to consider whether any and what steps should be taken in reference to the Royal Commission, appointed to inquire into the Pollution of Rivers), held at the Queen's Hotel, Birmingham, on Friday, the 21st of December 1866.

Present:

W. B. Clegram, Esq. | E. Leader Williams, Esq.
W. C. Copperthwaite, Esq. | Thomas Wilson, Esq.
Fereday Smith, Esq.

Fereday Smith, Esq., in the Chair.

It was Resolved:—

(1.) That in the opinion of this Committee, it is desirable to prevent the passage of sewage into navigable streams or their feeders, except after it has passed through a filtering or settling tank, and that provision should be made for altogether preventing chemical refuse, whether liquid or solid, from being mixed with the sewage water, or from passing into navigable streams or their feeders.

(2.) That the Committee strongly deprecate the practice of throwing cinders, rubbish, excavations, or other solid or bulky matter into navigable streams or their feeders, and are prepared to recommend legislation with a view to prevent the evil.

(3.) That in the opinion of this Committee the following legislative measures are necessary for securing the above objects.

Power to riparian owners, owners of navigations and waterworks, municipal corporations, improvement commissioners, fishery boards, local boards of health, and sewer authorities, to prosecute for any of the above offences, when committed either within their jurisdiction, or at any point above their jurisdiction.

Prosecution to lie against, and penalties to be inflicted on, the person causing the offence, as well as against the actual offender.

Power to courts to grant injunction on the application of any party who can show reasonable grounds for applying for the same.

(4.) That a copy of the above Resolutions be transmitted to the Secretary of the Royal Commission.

(Signed) Fereday Smith,
Chairman."

Bradford, Tuesday, 13th November 1866.

Present:

ROBERT RAWLINSON, Esq., C.B., in the Chair.

John Thornhill Harrison, Esq. | Professor John Thomas Way.

BRADFORD.

W. Brayshaw, Esq.

13 Nov. 1866.

William Brayshaw, Esq. (Bradford), examined.

8630. (*Chairman.*) Are you mayor of this borough?—Yes.

8631. How long have you been resident in Bradford?—For nearly 50 years.

8632. Are you engaged in any business in Bradford?—Not at present.

8633. Have you been engaged in any business?—Yes; I have been a builder all my life.

8634. What is the name of the stream or beck upon which Bradford stands?—Bradford beck.

8635. Is that the principal stream flowing through Bradford?—Yes.

8636. What condition was the Bradford beck in when you first knew it?—It was very different to what it is at present.

8637. Was it in a purer state?—Yes, a great deal; it has kept continually getting worse.

8638. I believe the population of Bradford has grown very rapidly during the last 50 years?—Very rapidly.

8639. And its manufactures have increased very largely, have they not?—Yes.

8640. With the growth of population and the increase of manufactures the pollution of the river has also increased?—Yes.

8641. Refuse material from manufactures has been passed into the river as the readiest method of getting rid of it, has it not?—Yes.

8642. Do you know whether any inconveniences have been experienced in Bradford in consequence of the pollution of the beck?—The course of the beck has been continually straitened by the refuse being put into it in various ways, and we have had very serious floods in Bradford. I have seen a cart swim across a very little distance from this spot, we have had several very bad floods, and much damage has been done to property.

8643. In consequence of the obstruction in the beck by solid material having been thrown into it?—Yes; the obstruction continually accumulates.

8644. Have any manufacturers, either within the borough or without the borough, as far as you know, thrown their furnace ashes into the beck?—Yes.

8645. Both within and without the borough?—I know they have done so within the borough, and I have no doubt they have done so without.

8646. Do you know whether foundation material has also been tipped into the beck occasionally?—I do not think that that has been generally done, it may have been at times.

8647. Has there been any jurisdiction exercised in order to prevent that kind of pollution up to this time?—Very little has been done.

8648. Have you as a corporation any control over the beck now?—If the officers could only catch the parties when they were putting the refuse in, the parties would be summoned, but they generally manage to do it where no one can see them, at least in the worst cases they do.

8649. Supposing you have jurisdiction within the borough, have you any jurisdiction outside the borough to prevent this form of pollution?—No.

8650. Then if you did all that could be done within the borough, and spent all the money that might be desirable to remedy this state of things, you would still be liable to suffer from the misconduct of persons outside the borough?—Yes.

8651. Would it be necessary, for the proper regulation of the river, that the jurisdiction should be as extensive as the river itself?—Yes.

8652. That you should have power over pollutions of every form, and over the entire river area and its tributaries?—Yes; I believe that that would be a very good thing.

BRADFORD.

W. Brayshaw, Esq.

13 Nov. 1866.

8653. Have there been any discussions in your town council with regard to the utilization of the sewage?—There was a great deal a few years since, and once they talked about trying to utilize it; it was said that much money might be made by it, but no result came from the discussion.

8654. The whole of the sewage now goes into the Bradford beck?—Yes.

8655. What becomes of it after that you do not know, except that it flows down the polluted stream to some other place?—Yes, it goes down to Shipley from here.

8656. Have you been threatened by any parties with injunctions or lawsuits for polluting the Bradford beck?—I am not aware that there have been any; I am told that there has been one in the case of a Mr. Constable.

8657. Are there any other remarks that you wish to offer the Commission?—It seems to me that if we had the same control over the becks that we have in the case of other nuisances, it would be a great improvement; suppose, for instance, that there was an accumulation of ashes from any mill placed so that we knew it was intended to go into the beck, if we had power to remove it, and charge the owners with the expense, it would be an improvement. As a proof of the beck and the canal and all those places getting so much worse, I may state that when I was a boy I bathed in a place called Cheese Hole, in Thornton Road; that now is completely like mud. I learned to swim in the canal down here, where now, if anyone puts a rod down, it will almost stand in the water without going to the bottom, the water is so thick. I do not think there has been any swimming there for the last 20 years. So far as the corporation is concerned and the borough, you may be aware, perhaps, that there is a very extensive system of drainage going on; we are doing our utmost to drain the borough, but we cannot drain the borough without polluting the streams. Seeing that the public look to the corporation for carrying out a system of drainage, we think that we have a right to look to the Government for assistance after we have done our utmost.

8658. You think that the Government might consider the matter and see whether they could afford you greater facilities for utilizing the sewage of the borough?—Yes; we can do no more than we do; we cannot drain the borough without polluting the beck.

The witness withdrew.

J. V. Godwin, Esq.

JOHN VENIMORE GODWIN, Esq. (Bradford), examined.

8659. (*Chairman.*) Are you engaged in any business?—Yes, I am a stuff merchant.

8660. Have you lately served the office of mayor in the borough of Bradford?—Yes.

8661. How long have you known Bradford?—A little over 44 years.

8662. Do you remember the state of the beck and of the streams at that time as compared with their condition now?—There was some little pollution near the centre of the town, but it was very small; it has been increasing with the growth of population and with the growth of trade; it has extended up those streams, it exists more or less throughout the whole of the borough wherever those streams go.

8663. And beyond the borough?—Yes; Bradford is in a basin, streams come down the valleys and unite in one, and they all run down the valley to Shipley, and then enter the river Aire.

8664. Bradford, I believe, has grown very largely in the last 50 years in population, has it not?—Yes; it has grown very largely in population. You will have a table put before you; but the population does not represent the growth of the trade. The census in 1841, for the borough, was 66,000; in 1851 it was 103,000; and in 1861 it was 106,000; but during the time when the population was nearly stationary a very large increase of the trade had been going on. For instance, the Board of Trade returns show that our exports, not from Bradford, but from the worsted district of which Bradford is the centre, were about 9,750,000*l.* in 1862; more than 13,250,000*l.* in 1863; about 16,250,000*l.* in 1864; about 18,750,000*l.* in 1865, and they may possibly reach 20,000,000*l.* this year.

8665. So rapidly is the trade of the district increasing?—Yes; owing to the introduction of machinery, the productive power has increased more rapidly than the population. The contamination of the streams has increased rather according to the growth of the trade than according to the increase of the population.

8666. As one might anticipate, seeing that the streams are used for the processes of manufacture in one way or another?—It has increased recently from the refuse of the dyeworks, and from soapsuds and refuse of various other kinds produced in manufactures.

8667. Do you think that there is any probability of this rapid progress being checked by the polluted condition of the streams, unless something is done to prevent the pollution, or to overcome the evil?—No, I hardly think that that will be the case, because we have waterworks that give us an ample supply of water, otherwise trade would be checked.

8668. Your waterworks which have cost you so large a sum of money are beneficial for a double purpose, namely, for domestic and for trade purposes?—Yes, for both.

8669. In laying out those works, I suppose you have had in view the accommodation of trade equally with the social comfort of the inhabitants?—Yes, quite so; they have made provision for a large extension of trade.

8670. That being so, do you think that you would be justified in extending the trade and further polluting the river?—We shall extend our trade at whatever cost, even if it results in increased pollution.

8671. Would you say that if means can be found by which a great proportion of this pollution can be prevented without injury to trade, such regulations should be put in force?—Yes, decidedly, we should all be very glad of anything that can be done.

8672. Those regulations should be as extensive as the sources of pollution?—Quite so.

8673. It would not do to make an exception with regard to Yorkshire, or any part of it, but if Parliament legislates you think it should legislate for the entire trade of the kingdom?—Yes, decidedly so.

8674. Is there much dyeing carried on in and near Bradford?—A very large amount; the principal part of the goods belonging to the trade are dyed in and about Bradford.

8675. I believe the Bradford goods are of a finer quality than the general trade of Yorkshire?—Some portions of them are, but I should not say that the wools which we use are finer than those which are used in the Leeds trade, they are a different class of goods entirely.

8676. You do not manufacture broadcloths?—We manufacture hardly any cloths here, they are chiefly worsted goods.

8677. Like the Galashiels manufactures?—Some portion of it is, but not very much, we use woollen yarns here to some extent.

8678. Do you know whether any of the Yorkshire trade has been absorbed by the Scotch, in consequence of their superior advantages in water?—None of our Bradford trade has of late years; it was the case some time ago when Bradford trade opened out as a fancy trade. A portion of it went to Glasgow, but I do not think the change had any reference to the water, they got the start of us in the fancy trade I think, but it is the other way now.

8679. Where do the wools principally come from that are used in Bradford and the neighbourhood, are they English or foreign wools?—I should think that we use quite as great a weight of foreign wool in

Bradford as of English wool. We consume here more English wool than is consumed anywhere else. We have it from all parts of the world; coarse and fine and every description of wool is used here.

8680. About what weight of wool per annum is brought into Bradford and consumed?—We have no means of ascertaining that, we might roughly calculate it from the exports from this district.

8681. Does the import of wool bear a proportion to the export of goods?—In giving you the amount of exports I took it from the Board of Trade returns. They are under the heads of "Worsted Stuffs," and also "Woollen and Worsted Yarns." We do not export woollen yarns, we import them, all the yarns which are exported from this district are worsted

8682. I suppose you consider that whoever drew up this Commission took a very wise view when they inserted these words, that "the inquiry as to such pro-"cesses and manufactories should be how far the pollu-"tions can be got rid of *without injury to trade?*"—I do.

8683. That you think is an element which must come into the calculation?—Yes, it should be some system which should not injure trade. It should also be not too expensive, and I think it should be compulsory, so that all will be brought in. Generally speaking, if a system like that is brought in, I think you will find that everybody in this district will be desirous to assist in carrying it out. I am sure that those gentlemen who assist, in the way of trade, in making these nuisances, simply do so for want of a better mode of getting rid of the refuse.

8684. I have no doubt that you have paid attention to the policy of our Government, and I daresay you are aware that it generally contrives to let things alone rather than to over legislate?—Yes, and that I think is a very sound principle.

8685. Do you think that any permissive form of legislation will effect the improvement contemplated in this case?—No.

8686. I mean permissive to this or to that town, or this or that manufacturer, to put in force the remedial measures which may be recommended?—If it were made permissive generally, or if certain towns had the power to make it compulsory throughout their jurisdiction, the law might be carried out; and you would find Bradford and many other towns disposed to do so, but we should be prevented here from doing so by the complication of our streams. I think that the whole of the West Riding of Yorkshire ought to be taken together, otherwise we could not deal with the question.

8687. Are you aware that the common law of England is powerful to forbid a nuisance of this kind, but that it is not simple and easy to make the power available?—It does not do it, at all events.

8688. You know, do you not, that a person may be restrained by an injunction in chancery from committing a nuisance?—Such a law would be very difficult of application in Bradford. It would be difficult to fix the offence upon the offending individual.

8689. Taking that to be the law at present, and that it compels, as it were, one neighbour to prosecute another, do you think that that is a desirable law, and that you are to be told, "There is the common law of "the land, and there is the remedy you may resort "to?"—That plan was tried on one of our becks to a very considerable extent some years ago, but it was abandoned because it was found practically inoperative.

8690. In the event of any law being enacted with regard to the pollution of rivers it might be necessary that powers should be given to acquire lands, supposing irrigation is proved to be the best mode of getting rid of town sewage. As the law at present stands you must appeal to the Lands Clauses Consolidation Act for arbitration powers. Is that, in your opinion, the wisest and best method of proceeding that could be devised with regard to the purchase of land?—As far as my experience goes as chairman of our Streets Improvements, it is a very dear and costly mode of acquiring land.

8691. Could you suggest any mode that would be less costly?—I think not. We have acquired land to a large extent under those powers, and we have had to pay extravagant amounts.

8692. Do you think that the machinery of the Lands Clauses Consolidation Act affords any facilities to grasping individuals?—I do not think that the provisions are exceedingly unfair. I think that where compulsory powers are given you must expectto pay.

8693. Where you have to prove the value of the injury done to land by evidence, is it not possible to multiply that evidence to any extent?—Yes, to a great extent.

8694. The law expenses are very great, are they not?—They are very heavy. We avoid them, as far as we can, by private negotiation, and by limiting the number of witnesses by agreement. I am not prepared to take a general objection to the Lands Clauses Consolidation Act, for I think that individuals should be protected where the property is taken from them, but it is a very costly mode of proceeding.

8695. Perhaps some check might be put upon the proceedings if persons who litigate vexatiously should be mulcted in some of the extra costs they had forced upon their opponent?—That is the case at present. If you make an offer, and the verdict is below it, the costs fall upon the party who has caused them. There are several points in working the Lands Clauses Consolidation Act on which I think Parliament has had sufficient experience to lay down fixed rules; for instance, with regard to the extra per-centage to be put upon the value in consideration of the fact that the land is taken compulsorily. Those points are open at present for the jury or arbitrators, but I think certain rules might be laid down.

8696. During your mayoralty did you have any discussions at all with regard to the utilization of the sewage?—None whatever.

8697. Had the corporation any complaints brought against them for the pollutions they caused?—Yes, we have had notice of proceedings on behalf of Mr. Stansfield.

8698. Have you a branch canal which has been very much polluted also?—Yes.

8699. Have any proceedings been taken with regard to that canal?—Some private parties did take proceedings against the canal proprietors, and I believe that an injunction binding them to remedy the evil comes into force this month.

8700. What will be the result of that injunction?—They will find it very difficult to supply the canal with clean water. There has been a talk of selling the canal to the Leeds and Liverpool company, in which case they might pump clean water up. It has often been said that it might be well to close that canal and form a tramroad or an ordinary road down to Shipley, and do away with it as a canal. I think it is impossible for anyone who has not lived in Bradford to conceive the extent of nuisance that arises from that canal in summer time, the distance it reaches from its banks, and the intensity of its smell.

8701. The water of the canal is comparatively stagnant?—Yes.

8702. In that respect it differs from the beck, which is more or less in motion, does it not?—Yes. I can recollect when the canal was quite clean.

8703. Do you know whether the beck has been impeded to any serious extent by solids which have been thrown into it?—I do not think so many solids have been thrown into it of late as used to be thrown in. I recollect when it was customary for some dyers to put their ashes and dye wares in, so that in case of a flood they could be sent down the beck, but I do not think that that has gone on so much lately.

8704. Is that done to any extent now?—I have no doubt of it.

8705. I suppose you would say that the jurisdiction of the borough should exist outside it as well as within it?—Yes.

8706. (*Mr. Harrison.*) Does not the beck pass through private property to a considerable extent?—Yes.

8707. Are the banks built upon?—It is built upon in the centre of the borough, and the beck is arched over in many places.

BRADFORD.

J. V. Godwin. Esq.

13 Nov. 1866.

8708. May those buildings have communication direct with the beck, so as to pass pollution into it?—The ordinary sewers of the town discharge themselves into the beck. They used to discharge themselves quite in the centre of the town. They have lately been taken a little below.

8709. Those buildings above the beck could with ease pass polluted water into the beck, but it would be difficult to point out the exact places?—Yes.

8710. It seems necessary, in a case like Bradford, to give to the town authorities the power of keeping the beck which runs through their borough in a pure state?—It can never be dealt with in any other way.

8711. It would appear requisite that there should be some persons with authority over the beck, and who might call upon the Bradford authorities to keep it pure if they did not attend to their duty?—Yes, if the law was general we should not complain; if we had the power to prevent others we could not complain of being prevented ourselves.

8712. You think that the borough authorities ought to look after individuals?—Yes.

8713. But there must be an authority *ab extra* that should have the power to call upon the borough authorities to keep the beck in order?—Yes, the streams should be kept pure down to the sea.

8714. I suppose there was a very slight increase in the population of the borough of Bradford during the 10 years from 1851 to 1861, but in the township itself there appears to have been a diminution of something like 4,000, is that so?—Yes.

8715. How do you account for that diminution?—By the increase of buildings of a different class; cottages have not increased in the borough.

8716. In those 10 years a large extent of warehouses was built, does that account for it to any extent?—I do not think it does, I do not believe the returns of 1861 were correct. The circumstances of the trade would account for a very large portion of it; we had at an early period a large body of hand-combers, but combing began to be done by machinery, and the class of hands was somewhat changed; we had fewer hands of the class of combers, but they were paid more. The productive power of the trade of the town was very largely increased by the introduction of machinery, more especially by machine-combing instead of hand-combing.

8717. You gave us just now the extraordinary increase in the manufactures from 1861 to 1865 or 1866, whilst there was apparently no great increase in the population that you accounted for by the use of increased machinery?—We believe that the population has been increasing since 1861, we estimate now that it is something like 124,000 or 125,000, but it is only an estimate.

8718. How do you account for that rapid change in the population again?—We cannot introduce machinery perpetually that will dispense with hand labour as was done in the case of the combing machines.

8719. The canal company I suppose had power to take water from the beck originally when the canal was formed?—I think they claimed all the water and all the sewage of the town.

8720. In what year was the canal made?—I cannot say.

8721. Is it many years ago?—Beyond the time that I can recollect.

8722. Was the beck at that time in a comparatively pure state?—Above the centre of the town, as far back as my recollection goes, there was some little pollution, a few suds went into it, and a few dye wares, but not very many; the pollution was only to a very small extent; the beck was left clean for a considerable part of the day.

8723. Therefore the canal authorities have had just ground of complaint against the polluters of the river?—As to those legal points it is difficult to speak. I think the canal company have failed in their duty, I think they were bound to acquire a good supply of water, but differences of opinion will exist upon those points.

8724. There appear to be a great many ashpits in your borough and cesspits, is that so?—We have a very large number of ashpits; the borough surveyor will be able to give you the particulars as to them, because the corporation empties them all.

8725. Is the system of waterclosets not generally carried out in the lower class of houses?—No, not at all, or to a very small extent.

8726. Is the corporation put to any considerable expense in emptying those cesspits?—I think the last contract for two years was something over 5,400*l*.

8727. (*Chairman.*) Have you anything further to add?—No. I may say that I concur generally in the evidence that has been given by the mayor. I remember when these streams were very clear, for I used both to bathe and fish in them, and I hope to live to see the canal clear again.

The witness withdrew.

WILLIAM THOMAS MCGOWEN, Esq. (Bradford), examined.

W. T. McGowen, Esq.

8728. (*Chairman.*) You are town clerk of this borough?—Yes.

8729. I believe you have not long held the appointment?—No, I have only recently been appointed.

8730. You had previously occupied a legal position in Liverpool?—Yes, I was deputy town clerk for 14 years in Liverpool.

8731. You have paid special attention to sanitary questions?—Yes; amongst other things I had charge of the administration of the sanitary laws in Liverpool during my period of office there.

8732. Have you had occasion to study the question of river pollutions?—Yes. It was forced upon the attention of the authorities of Liverpool in a slight measure, but by no means to the same degree as upon the attention of the authorities of this town. Objections were made to the discharge of the sewage of Liverpool into the river Mersey on the ground of alleged deposits being made on the banks, but the width and depth of the stream and the rapidity of the tidal current greatly facilitated the carrying away of offensive matter, if they did not effectually carry it away. Here the conditions are quite reversed.

8733. Have you a copy of the charter of incorporation to put in?—Yes.

8734. The borough of Bradford was incorporated on the 9th June 1847, was it not?—Yes, this is a copy of the charter of incorporation (*handing in the same*).

8735. Various local Acts of Parliament have been passed and have come into force since that period?—Yes.

8736. Can you specify them?—The first Act was that which is called the Bradford Improvement Act, 13th and 14th of Victoria, passed in 1850. That Act incorporated nearly all the provisions of the Public Health Act of 1848, and a number of the provisions of the Towns Police Clauses Act of 1847, and of the provisions of the Towns Improvement Clauses Act of 1847. In consequence of incorporating the sections of the Public Health Act, the corporation have had to administer the Local Government Act of 1858, the Local Government Act of 1861, and also that of 1863, so that all those Acts are now in force within this borough.

8737. Have you enacted any byelaws?—Yes, we have. You are aware that under the provisions of the Municipal Corporations Act, 5th and 6th William 4th, all corporations are empowered to make byelaws with regard to matters affecting the comfort of the inhabitants; under that power the corporation of Bradford did, on the 27th May 1848, frame a code of byelaws which I will now hand in (*handing in the same*).

8738. Have they not been amended since that time?—No; I should also say that the Local Government Act of 1858 abrogated the specific directions as to buildings contained in the Act of 1848, and in lieu of those specific directions gave authority to local boards to frame byelaws for regulating buildings; under the powers of the Act of 1858 the corporation framed a code of byelaws; that code they have altered two or three times, and in the revised form it has recently

received the sanction of the Secretary of State; a copy also of that I will supply.

8739. Does the Bradford corporation hold any property in the way of markets, gasworks, waterworks, or market tolls?—Yes, all except gasworks.

8740. Do they possess any landed property?—Yes; they are exclusive proprietors of the waterworks; they are also exclusive proprietors under an Act of Parliament which they obtained last session for the purchase of the markets and of the market tolls, and they have the management of that property. Under the Local Government Act of 1858 they have obtained, with the sanction of the Secretary of State, provisional orders, followed by supplemental Acts of Parliament, for taking property for street improvements; and they have in this way acquired in different parts of the town buildings and lands for improvements, portions of which now remain on hand. I should mention, as to property, that they have established baths and washhouses of which they are the proprietors. Again, under the Burial Acts they have acquired possession of a public cemetery of which they are the proprietors.

8741. Is there a town hall in Bradford?—No, but we have offices and we have committee rooms.

8742. Does this building (St. George's Hall) belong to the corporation?—No.

8743. You have to hire rooms?—Yes; the only suite of apartments that we have are those which you have seen in Swain Street.

8744. Are they adequate for the business of the corporation?—They are certainly inadequate.

8745. What was the population of Bradford at the last census, and what is the estimated population now?—It is now supposed to be above 130,000. I am told that it was 106,218 at the last census.

8746. What is the rateable value of the property in the borough now?—376,038*l.* last year.

8747. Is the soil of Bradford beck in any way vested in the corporation?—That is a matter not very clearly defined. The proprietors of the property on each margin of the beck have hitherto claimed a right to the soil and freehold of one-half of it, and I believe that in many cases that claim has been allowed; I am, however, by no means clear that they were entitled to it, but they have claimed the right and they have exercised it.

8748. Supposing you should wish to deal with that beck for the purpose of general improvement, such as walling the sides, regulating its width, and pitching its invert, so as to pass refuse at a uniform level, would a special Act be required to give you the necessary powers?—Clearly.

8749. Would it be impossible to frame a general Act that would give that power to all corporations?—We should want an Act, but a general Act would be far preferable.

8750. Is there any water power within the borough for mill purposes; I mean for waterwheels?—Yes.

8751. Are there any mills within the borough?—I know of two or three mills.

8752. That mill power, whatever it may be, must necessarily be purchased if it is to be dealt with?—Yes, if it were to be interfered with injuriously.

8753. Statutory powers would enable you to sweep away the mills as they might obstruct the stream?—I think that the mills on the streams are now of such an age that the owners have a right to use the water, and that they could not be divested of that right except in the usual way by statutory powers and compensation.

8754. Do you think that the Lands Clauses Act provides the best conceivable machinery for compulsory purchase and taking possession of lands and properties which are required for improvements?—I do not think it does.

8755. Do you not think, after the experience you have had, that a more simple process, and quite as just to both parties, might be devised which would be more efficacious?—I am sure of it, and I will give you an illustration on that matter. In 1864 I had to prepare a sanitary bill for Liverpool for the purpose of dealing with the courts and alleys; we knew that we should have to take large quantities of property of a certain value compulsorily, and that if the powers of the Lands Clauses Act had to be put into operation we should, by means of the cost that would be cast upon us, be frustrated in our object. We therefore arranged that if there should be a dispute as to the valuation, the parties should not have the option to say, as they have now, "that is a point to be "decided under the Lands Clauses Act," and make us go to arbitration, but that we should be at liberty to take the parties before a jury. Practically, the course, under the Lands Clauses Act, is that parties whose property is required may compel the body who are seeking to take the property to go to arbitration; this generally means the appointment of two arbitrators and an umpire, the evidence is all written down, much time is consumed, and an enormous expense incurred.

8756. In point of fact it is a very lengthy and costly mode of inquiry?—Yes.

8757. Have you ever compared the relative value of the property which has been brought into question with the amount of the legal expenses upon an arbitration?—Yes; but it would be impossible to give you any per-centage. I have no doubt that great contests have taken place before arbitrators upon rights of way where the matter in dispute has not been worth much. Under ordinary circumstances it is as expensive to contest a question before arbitrators when the matter in dispute is of small value as when it is of great value, because there is the same machinery to be employed. There is a long string of witnesses to be examined, learned gentlemen to be called in, a formal investigation to take place, and the evidence to be written down, much more redundant evidence than judges permit, the result of which is that the authorities who have to buy the property are in a manner constrained, and very frequently as a matter of prudence, go a little bit beyond what would be the fair value, I mean in special cases, in order to save expense and settle the matter.

8758. You will see no doubt that private rights would be very largely involved in the prevention of river pollutions if legislation were to take place for that purpose?—I entirely acquiesce in that, and the valuation question is of the first magnitude.

8759. If a cheap and simple law could be enacted to deal with that question, it would be well worthy of the consideration of Parliament when the other great measure was being considered?—Yes. I consider that that is a matter of the greatest importance as affecting any corporation where the acquisition of property is concerned, the cost of it being the most serious element.

8760. If the sewage is to be carried beyond the boundaries of the borough land must be acquired upon which to dispose of it, and new rights must be acquired over that land. If, therefore, a simple mode of arrangement can be devised by which those rights should be acquired, I suppose you think that all parties would be benefited thereby?—There is no question about it. Certainly there is required some more simplified and less costly mode of getting at the real value of property. I have no doubt of this, because I have had professionally to tax bills of costs of gentlemen where they have succeeded, and I have had to take considerable sums off their claims. I know by experience that it would be much to the benefit of the vendor if a less expensive mode of dealing with these matters was devised, because all the money that is taxed off a bill comes out of the purchase money which the vendor receives.

8761. Do the corporation themselves cause any nuisance to the beck that runs through the town?—We say not, and for this reason, in the first place, the refuse has been discharged into the beck for a very long time, and although by the adoption of water-closets there may be an additional quantity of solid matter sent in now, compared with what went in formerly, yet the increased volume of water that is sent down, I mean the water collected from other sources than the river, such as catchment water, more than compensates for the additional inconvenience which has arisen in that form.

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8762. I suppose you would feel bound to confess that so far as you permit, under your regulations, sewage to flow into the beck you pollute the beck?—No doubt of it, but, as you know, that is the misfortune of all inland districts.

8763. The question is, whether or not that can be prevented, and when I use that term I mean prevented in a common-sense way, not in a ruinous way, but in a way that shall be beneficial to all parties, and within the means of all parties concerned?—Yes, subject to those conditions, prevention would be a boon.

8764. Are there any other polluters of the streams besides the corporation of Bradford?—I should say that the pollutions caused by the corporation are insignificant as compared with other pollutions.

8765. Whatever amount of pollution may flow from Bradford is only a fractional part of the whole of the pollutions that are passed into the Aire?—No doubt of it.

8766. Suppose that the people of Bradford were to do their utmost to prevent this form of pollution, either by sewage, irrigation, or otherwise, do you think that their example, however clear and obvious it might be, would necessarily be followed by the other towns lying above and below you?—One does not find that to be so in practice.

8767. Therefore, although you as a corporation might be wise enough and willing to do what was necessary, you think there would still be required some general measure in order to compel all parties to do alike?—I have not a doubt of it.

8768. Does the water come down to you at Bradford polluted from above?—I understand that it does.

8769. Is the river also polluted by the towns below?—Yes; I believe there is no question of that.

8770. What is the common law with regard to the pollution of a river?—Really it is an impracticable law; for supposing that a gentleman wished to complain of a person who polluted the river, and that he was bold enough and that his purse was heavy enough to induce him to embark upon an indictment, the first difficulty that he would meet with would be to prove who was the offender; and as a rule, inasmuch as an indictment must be at the instance of some one as the prosecutor, partly from fear of expense, partly from good feeling, and partly from the difficulty which there would be in fixing upon anyone as the cause of the nuisance, the offenders being so many, the common law becomes absolutely inoperative, with a few exceptions. Now and then one hears of an indictment succeeding, where somebody can be fixed upon as producing a given nuisance, but the cases are by no means many.

8771. May not the success of those indictments in particular cases be an intolerable hardship to the individual concerned when he is mulcted, and every other offender escapes the penalty of his misdoing?—I think it is a very great hardship.

8772. In that way one man might be ruined who had not done more than perhaps 10,000 other persons in the country?—No doubt of it; and if you put that individual, by reason of legal proceedings, under some constraint to expend money, to the extent of the necessary outlay you place him at a correlative disadvantage with other manufacturers who are left free from a like obligation.

8773. Have you at all considered the question of sewage irrigation?—Yes.

8774. With reference to its practicability, or as to its difficulties?—Yes, I have. On one occasion I accompanied our esteemed friend, Mr. Newlands, the borough engineer of Liverpool, and Dr. Trench on a mission to different parts of the country, to see whether we could obtain any information that would enable us to utilize the sewage of Liverpool.

8775. At what conclusion did you arrive?—We were rather in favour of the notion. Of course my views at that time were directed to Liverpool, but in a mere sanitary view we saw nothing better than we were doing. We were on the margin of the river Mersey, and by means of the river could get rid of the sewage, so far as it was a nuisance, and we considered that that was the best way to deal with it.

8776. At Liverpool you have a great tidal estuary?—Yes, with 20 feet fall of tide.

8777. And there is a sandy mouth and banks outside the estuary?—Yes.

8778. Have you considered what legal difficulties you would have to contend with if you were put under constraint at Bradford to utilize the sewage?—Yes, I have, and they are very alarming. The legal difficulties would be great, because virtually our powers cease with the limits of the borough. I speak of things as they are.

8779. (*Mr. Harrison.*) But you would have compulsory powers, would you not?—Yes, under a recent Act, the Sewage Utilization Act we might go a further distance for the purpose of having sewage works. That might be done by agreement, which, I must tell you, means in practice going with your cap in hand to people through whose land you wish to pass, and accepting whatever they may be pleased to give you. And then again I take it that this would be a certain consequence, viz., that if by our operations we annoyed another village or town, we should not be placed above the common law. We should be fixed upon as specific offenders, and the neighbouring village or town might ask us to account for our deeds. Then comes the question, where is the place to be found suitable for the operation supposing that the most liberal overtures on the part of the corporation were made.

8780. (*Chairman.*) You fancy that there would be legal and other difficulties in your way?—Yes, I do, in dealing with Bradford *per se*.

8781. Would one of the difficulties be the difficulty of providing the necessary funds?—On that question I would say yes, there would be a great difficulty. If I were permitted to give expression to my opinion it would be this, that as these operations are of national importance, and the measures necessary to carry them out may assume national proportions also, the Government ought to do what they do not do now; that is, give their assistance by advances from the Public Works Commissioners. As things are now, all the money which public authorities want they have to get by going into the money market and competing with commerce for it; and yet having no commercial object to serve, they are forced to pay a high rate of interest, and return the money in a comparatively short time. This is a point which I think is entitled to very grave consideration, and I wish to take this opportunity of urging it upon the consideration of the Commissioners, that with regard to any works of this kind that may be undertaken by local authorities at their own expense, they should have a right to appeal to the Government to assist them, and should be enabled to obtain funds from the Public Works Commissioners repayable by instalments over a long period, and at an easy rate of interest. This is what the Government can do if they will.

8782. What is the amount of the present debt of the borough?—About 1,000,000*l*.

8783. What rate of interest do they pay?—About 4½ per cent. besides expenses.

8784. Supposing you could obtain the money from the Exchequer Loan Commissioners, as a loan was obtained for Lancashire at 3½ per cent., what annual saving would that be to the borough?—That is a matter of calculation, but of course there would be a saving of one per cent. upon the interest. Then the great boon would be not merely in a reduction of interest, but in the longer period given for repayment.

8785. Would there not be something like 10,000*l*. a year saved?—Yes.

8786. If you could treat with the Government and induce them to lend you the whole of your capitalized debt at 3½ per cent., and give you 30 years for the repayment?—I would ask for 50 years for works of this kind. Lord Redesdale has consented to give in some instances 50 years for local works. He allowed 50 years for a work that is of a very kindred nature to this.

8787. What security could you offer to the Government?—We could offer the whole of the property of Bradford in the shape of a rate.

8788. Therefore the Legislature could not say that it was a riskful mode of laying out the money, because it would be a very safe basis for a loan, while an enormous amount of good might be effected by it?—It would be so safe a basis that my legal friends will tell you it is now a very common thing in settlements and wills to give power to trustees to invest funds, not merely upon land or government securities, but upon securities of this description, and that they prefer them to railway debentures in good companies.

8789. What is the amount of your local rates in the pound?—I think it is something like 6*s*.

8790. That there would be a saving of 10,000*l*. per annum I think must be quite clear to everyone, and it would be an enormous boon to Bradford?—Unquestionably it would be.

8791. And it could not injure anyone else in the kingdom?—It could not injure anyone; it would be an unmixed benefit. In my opinion it is assistance which local authorities are entitled to ask for at the hands of the Government, and the money would be expended for the good of the public, because the nation at large participates in the well-being of its district towns.

8792. I know that you have paid sufficient attention to sanitary legislation and sanitary works to have formed an opinion as to whether, if money has been judiciously laid out upon them, an equivalent has been obtained in improved public health, and in a direct and indirect saving of the rates, poors rates especially, and in the general welfare of the community?—Yes, I have long entertained a very strong opinion upon that subject, so strong that I took occasion once to submit to a meeting over which Lord Shaftesbury presided a statement showing what the actual gain to a community and to each family would be from an expenditure of money for sanitary purposes.

8793. If you paid five per cent. in the gross for the loan of a million, that would be 50,000*l*. per annum, but you pay more than that?—Yes, including expenses and stamps.

8794. You pay much more than five per cent., having regard to a sinking fund?—Certainly we do.

8795. Six or seven per cent.?—Yes, with a sinking fund.

8796. If you could capitalize all your loans and borrow money at 3½ per cent., an annual per-centage of something like 5*l*. 5*s*. 0*d*. would clear that off in 30 years?—Yes, and if the period were prolonged it would make it easier still. This is a point that I would respectfully take the freedom of urging most earnestly upon the attention of you gentlemen, not merely as to the particular question upon which you are embarked, but as to all sanitary operations.

8797. Have you formed any opinion as to any method of getting rid of the refuse from the town?—I have thought a good deal about it, but it is a question that is surrounded with considerable difficulty. The first question that presents itself is this, that any measure for the purpose must be of a general character, for instance, in this case it must deal with the whole of the water-shed of this part of the country. How that is to be done I cannot venture to say. Then the next question is, what would you do with the refuse? If you sent it to the ocean you would effectually get rid of it, but of course the products which one hopes might be utilized would be then thrown away. One great object in view for any district situated like this is, that the products may not be thrown away, but how that is to be done I offer no opinion. Everyone feels that nothing should be thrown away that can be saved, and if refuse can be utilized it ought to be. I believe that the next difficulty is the configuration of the land in this part of the country.

8798. Have you considered the question of a conservancy board for the regulation of the entire district, and the prevention of further pollutions?—Yes, I have.

8799. And the elements out of which such a board might be constituted?—It would be going almost into a perfect scheme, but I may state generally that this conclusion has presented itself to my mind, that unless the question is taken up as an imperial one, and unless the management is in the hands of officers connected with the Privy Council or the Government in their sanitory department, local assistance would have to be called in; and I see no other mode of establishing a conservancy than getting delegates to form a board who were connected with the districts to be affected by the operations proposed to be carried out. I might illustrate the matter in this way. Supposing any great outfall works to be made, either for the sewage to be carried to the ocean, or to some district where it could be intercepted, or cleansed and returned as water to the river, you must have an uniform action all down the districts to be affected; one place or person could not do it alone, and I fancy that none of them would consent to be excluded from participation in the jurisdiction.

8800. Are there smoke prevention clauses in the local Acts for Bradford?—Yes.

8801. Are they similar to those which they have in Liverpool?—They are more stringent.

8802. Are they put in force as energetically as they are in Liverpool?—No, not at all.

8803. Did you have to put them in force in Liverpool?—Yes.

8804. Was that attended with any beneficial effect or otherwise?—A very beneficial effect. The manufacturers admitted that there was a saving of fuel, whether great or little I do not know, and there was certainly an abatement of the nuisance. There, the rule that we acted upon was not to require any gentleman to adopt a patent, or any nostrum that might be offered, but simply to insist upon the stoker doing his duty in a proper manner, and the result I know at some of the largest works was very satisfactory.

8805. When you first visited Liverpool had that act been put in operation?—No. There was an old Act in operation in Liverpool, which was directed against the workmen, so that when informations were laid against parties and penalties were obtained, the workman in order to evade payment left his situation; but it was found that the Act became inoperative, and in 1854 an amendment Act was obtained which enabled the corporation to direct their attention to the proprietors of the works.

8806. Do you remember the smothering volume of smoke that used to come from the steamers at the landing stages in the Mersey?—Yes.

8807. At the present time you do not see anything of the kind?—There ought to be none, and if the steamers are properly looked after there is none.

8808. (*Mr. Harrison.*) You probably heard the ex-mayor say that a considerable quantity of water was used for trade purposes?—No doubt of it.

8809. And that one great object in having such a large water supply is to supply the necessities of trade?—Yes; I know of one dyer who carries on a large business, and who says that one of his objects in choosing the present site of his works was not only to get a good supply of water by boring for it, but that if the borehole supply were not enough he might be ultimately supplied at a low cost from the town's works.

8810. You have gone beyond the district of Bradford proper, I believe, into Wharfedale for a supply of water?—Yes, we have gone to a great distance.

8811. Do you know the proportion of water that you obtain from Airedale and Wharfedale?—No.

8812. Is not one effect of bringing water from a distance to increase the value of the property in the neighbourhood of Bradford?—I should say so unquestionably.

8813. Will you point out the difficulty that you mentioned in the way of applying sewage to land?—I mean that the land in the vicinity of towns gets otherwise covered. I am not prepared to say what the increase of the pollution is; but, as far as I understand, the effect of our increased supply of water is that although there is an increased volume of

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sewage, it is much less offensive in its character, and its flow is much more speedy.

8814. That would be in the neighbourhood of Bradford, but would it be so in the river Aire?—I think it would hold, *ceteris paribus*; if you get a large volume of water relatively to the solids to be carried away, you increase the flow and diminish the evil, by increasing the speed of the stream.

8815. You have stated that any measure that was passed should be of a general character; do you mean to say that it should be of such a general character as that no town should be allowed to turn its sewage into a river?—No, I do not mean that. This is my view of the subject: take Bradford as it is, and I ask where in the borough can you find a place for the deposit of the sewage, where you could, by a process of distribution over and absorption into the land, deodorize it? My answer is, nowhere; and then you would be constrained to go to another district. I should like you to obtain more correct information upon these points from Mr. Gott as to the configuration of the land, and so forth; but I understand that a good spot for deodorizing processes could not be obtained, except at a considerable distance. If a measure is to be forced upon the community, I contend that it should be forced upon all communities alike, and that it should be a general scheme for a general district. Let me illustrate this in another way, and this is a very serious feature in connexion with a deodorizing scheme; suppose land is acquired and conduits are made, and the sewage is delivered upon the soil, the corporation would be the managers of the estate, and they according to my experience are not very happy managers of property of that kind. Again, it is very desirable, if a scheme is to be carried out, that all persons affected should join in it.

8816. You stated a short time back that you thought the ocean would be a safe place in which to get rid of the sewage?—I know that you can get rid of it there, because I have seen it done.

8817. Are you aware that the sewage of towns situated near the sea, when carried into the ocean, is frequently a great nuisance?—No, I do not know that, but I can imagine it would be so where the tidal current is very gentle, and where the bulk of the sewage spreads over the sands, and where the rise and fall of the tide is but trifling.

8818. If a town like Bradford goes to a great expense for its own benefit, in bringing water in large quantities from an adjoining water-shed, as it does from the Wharfe, and thereby encourages an increase of population in its neighbourhood, and consequent pollution, would it be too much to call upon the town to go to a subsequent expense in removing the sewage that is so created, even to a considerable distance, for the purpose of distributing it on the land?—I do not think that any corporation would object to undertake a fair responsibility, but they would all like to know, before any expenditure was forced upon them, whether a satisfactory scheme had been decided upon. I think that a corporation ought not to experimentalize with public money, but they would not object to bear a portion of the burden. If the corporation is to join in some public measure, they would be fairly entitled to ask the Government to assist them with money on the easiest terms.

8819. And to give them power to take land compulsorily for the application of the sewage?—Certainly, if it were, as the chairman said, some simple and inexpensive mode of getting the property other than the costly way we have been speaking about.

8820. (*Professor Way.*) With regard to the general character of such a measure, do you mean that it should be general throughout the country, or general only in a district?—One part of the question admits of a ready answer; I think that if you set a plan in operation in one district, and leave others free from its operation, you are holding out a disadvantage to one class of men and not to others, as far as manufactures and commerce are concerned. It would be a desirable thing that all should be placed on an equal footing. It would be a most unjust thing to put this town, for example, under some control as to manufactures, and to leave another town free.

8821. Provided that all persons dwelling upon the banks of the Aire were to be put on the same footing, is there any reason why you should object to legislation for this district until, for example, the west of England was dealt with?—The way in which I would answer that question is this: if you could show that a change was valuable for the eastern side of the island, I do not think that you ought to delay your operations until you got a scheme ready for the western side.

8822. Might not a manufacturer say, "If I have to "compete with another district which is not placed "under the same conditions and the same prohibitions "as I am, I must compete with disadvantage." Or might he say, "Although I am put to some expense "and inconvenience in purifying the water I use "before I throw it into the river, still, as all my "neighbours are put in the same position, and as I "get pure water running past my mills in consequence, "I gain an advantage?"—The reply to that I think is this: if I was a manufacturer I should like to see everybody dealt with in the same way, all over the land, and if I could not get that I should require the people living in the same district at least to be dealt with in the same way.

8823. Should you be inclined to oppose or to acquiesce in legislation which dealt with this district apart from the rest of the country?—If it could be shown that there was a perfect scheme for the easternmost side of the island, I do not think that the operation of it should be delayed until you obtained a scheme for the western side of the island. At the same time I would say that whatever scheme you do devise, it is of the highest consequence, looking at the wonderful ramifications of the commercial operations of this country, that care should be taken not to dislocate any of the commercial arrangements which subsist, not to give one man an advantage over another. I have no doubt at all that very minute considerations affect the attraction of commerce to certain spots.

8824. Do you mean that the character or quality of the water in a district is a minute consideration?—It is a very important one.

8825. And if anything could be done to improve it, it would not be a very minute consideration?—In this district I do not think that the purification of the water is a matter of much consequence. Manufacturers get their supply of water either by boring for it, or, if they do not bore for it, they buy from us whatever quantity they want. There are those who do not mind its purity, and only want it for boiler purposes, and they can get their supply and they do get it from the beck, though not in a very pure condition.

8826. I suppose that when manufacturers first settled down by the side of these streams they came for pure water?—I cannot say what induced those manufactories to be established here.

8827. My previous question was this, whether you would be opposed to legislation for the rivers of the Aire and Calder separately and distinct from the rest of the country, if the same principle was subsequently carried out in other places?—As to the social effects I should say certainly not, but of course it might interfere with the manufacturing interests, and upon that I cannot give you any information. The only point upon which I feel strongly is, the paramount necessity for the Government to be more considerate with reference to advances of money than they have hitherto been, and I apply that particularly to the question which you have now under consideration. It is also desirable that there should be a simplification of the mode of acquiring property.

The witness withdrew.

Mr. Charles Gott, C.E. (Bradford), examined.

8828. (*Chairman.*) You are the borough engineer of Bradford?—Yes.

8829. How long have you held the appointment of borough engineer?—For 10 years.

8830. Where were you engaged previously to your appointment in Bradford?—I was engaged in Hull.

8831. In any other place besides Hull?—No, not in the same capacity.

8832. Will you be good enough to describe briefly to the Commission the area upon which Bradford stands, and the names of the becks which pass into and through it?—The plan which you see now upon the wall shows the borough of Bradford. The whole of the borough is situated in the valley of the Bradford beck, and the middle plan on the wall I have prepared to show the different levels of the land in and about the town and district. The colours on the map are so arranged that each colour shows 100 feet of level. I have coloured the spaces between the contour lines so that all the land coloured yellow is from 200 to 300 feet above the level of the sea, it ranges from that. The green represents from 300 to 400 feet; the purple next to the green represents from 400 to 500 feet, and the other colours range above that, as you will see, up to the summits of the hills. The plan shows distinctly to anyone who can follow those colours the way in which the hills and valleys lie, and the general conformation of the district in and about Bradford.

8833. What is the area of the borough of Bradford?—6,508 acres.

8834. What is the population?—The present population is estimated at 130,000. In 1861 the population was 106,000, but there has been since that time a very large increase in the population. I do not think it is now under 130,000 persons.

8835. What is the present rateable value of the borough?—The rateable value in 1865 was 376,038*l.* it is now 405,417*l.*

8836. What number of houses are there in the borough, occupied and unoccupied?—I believe that very few of them are unoccupied. The number of houses in the borough now is about 26,000, and I should not think that more than 100 of them are unoccupied.

8837. Is building going on rapidly?—Yes, very rapidly.

8838. Where are the chief manufactories situated?—The principal manufactories are situated in the valleys near the streams, but there are very large manufactories now erected away from the streams.

8839. What do you call these manufactories?—We call them mills chiefly and dyeworks; there are also ironworks.

8840. Foundries?—Yes.

8841. And gasworks?—Yes, we have gasworks.

8842. Are these situated near the streams?—Yes.

8843. Are there any chemical works?—Yes, and soap works.

8844. And also grease works?—Yes.

8845. Have you any idea as to the number of water closets in use in Bradford?—Yes, I believe there are nearly 1,500.

8846. Is there also a number of cesspits and ash middens?—Yes, and the number of the ashpits is a little over 6,000. We do not exactly know, we make a return of the number that are cleansed, and the number of them is about 6,000.

8847. What is the number of the privies which are attached to those ashpits?—About double the number of ashpits.

8848. About 12,000 or 14,000?—Yes.

8849. Are those privies and ashpits cleansed by the owners of them, or, when neglected by the owners, are they cleansed by the corporation?—They are all cleansed by the corporation.

8850. Under contract, or by men employed by the corporation?—They are cleansed by contract, by hand labour; the work has been now let for many years to contractors.

8851. At what cost to the corporation?—The amount at which the contracts are now let is 5,400*l.*, but that amount covers two years, it is 2,700*l.* for one year.

8852. That is so far I suppose a dead loss to the community?—Yes; that is the annual expenditure which they have to incur to get rid of the refuse and ashes from the houses.

8853. Does that sum include the street sweeping?—No, that is an extra expense.

8854. Where are the ashes and the night soil deposited when removed?—The ashes and the night soil, in fact all the refuse which is taken from the ashpits is the property of the contractor.

8855. But my question is what does he do with it?—He sells what he can, and the ashes are mixed with the soil so as to make them in a certain degree valuable for manure, and those I believe he can sell; the other refuse, dry ashes, broken pots, and miscellaneous rubbish, he gets rid of as well as he can; sometimes he pays something to be allowed to tip it and get rid of it upon waste land, or to put it in holes and different places.

8856. Has he any depôt near to any flowing water, or near to the Bradford beck at any point?—I am not aware of any, and I believe not.

8857. Where are the street sweepings taken?—The street sweepings are carted away from the streets by a contractor, that is under another contract, and they belong to the person who takes them away. The corporation have provided a depôt for the street sweepings to be laid in until they dry, and can be sold for manure.

8858. What sum of money do you pay for that work being done?—That is let in a different way, we pay for team labour so much per day, that is for a horse and cart and a man.

8859. What extent of main sewers have been carried out in Bradford, and at what cost?—We have made altogether a little over six miles of main sewers, or 10,720 yards, at a cost of very nearly 40,000*l.*

8860. What number of houses have you drained?—We have not drained many houses yet, except indirectly, and perhaps I might explain that the sewerage work of the town is a work that has only been recently taken up. It was first commenced in 1863, and the work has been divided into three parts. We are dealing with the sewerage works first by constructing an outfall sewer, a large main arterial sewer, and lines of main sewers intended to serve the largest districts. The second part of the work, at which we have not yet arrived, consists of making street sewers and minor sewers of every description throughout the district. The third part of the work will include the making of all house drains and private drains in connexion with the street sewers. As the work has been going on the practice has been to connect the existing drains with the new sewers in a temporary way, until the large main sewers are completed. The old drains will be taken up and new ones substituted for them.

8861. What is your estimate for an entire and complete system of main sewers?—The estimates have been made in parts, but the general estimate for all the sewerage works, exclusive of house drains, for which private parties would have to pay, is about 120,000*l.*

8862. Have you inspected the position of these cesspits and privies?—Yes, I know their position very well, they are very much of the same character throughout the town.

8863. Are any of them crowded together in the thickly peopled parts of the borough?—Yes, and that is the general fault of them.

8864. Are any of them to be found beneath sleeping rooms?—I believe not, not one of them. There is a provision in the Bradford Improvement Act which

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enables the corporation to prevent any person sleeping in a room over an ashpit or a privy.

8865. Are there not instances of the contents of cesspits filtering through and into adjoining wells?—Yes, we have had instances of that kind, but all the houses which have been erected since the building regulations made in the year 1850, under the Bradford Improvement Act, have been built under regulations that require ashpits and outbuildings to be placed in proper situations, and therefore the ashpits are now in every case kept apart and distinct from the houses.

8866. Are not the corporation the proprietors of the waterworks?—Yes.

8867. Can you give us readily the rainfall, the number of the reservoirs and the area of their gathering grounds, the cube capacity of the reservoirs, with the greatest depth, and the cost of the works?—Yes, I have prepared some information of that character. The large cartoon plan on the wall shows the scheme for the waterworks generally. I have a plan here, which I will hand in to you (*handing in the same*), which shows the scheme of the waterworks just as they are carried out.

8868. I will take the most distant reservoir, that of Grimwith, it is a compensation reservoir?—Yes. These works have now been in course of construction for the last 10 years, there was an old system of waterworks in use then, which is shown in black lines, and the yield at that time was not half a million of gallons a day, that was in 1850 before the new works were made, and it so continued until 1856. That half million of gallons a day (the works being situated about six miles to the west of Bradford) was entirely derived from the many well springs; those old works were bought by the corporation, and new works were commenced in 1856. I should mention that the new works affect the valleys of the two rivers the Wharfe and the Aire, and that the total quantity of water intended to be brought to Bradford is 10 millions of gallons a day from all the works when completed.

8869. Your most distant reservoir is the Grimwith reservoir, is it not?—Yes. Seven millions out of 10 millions of gallons are intended to be brought from the valley of the river Wharfe; the works consist of $10\frac{1}{2}$ miles of conduit or aqueduct for intercepting the streams, and conveying the water from the store reservoirs; there are two store reservoirs in that valley and one compensation reservoir. The area of the gathering ground from which the water is brought to supply the town is 7,550 acres, and the area from which the water is brought to give compensation to the river is 7,390 acres.

8870. Then you give an equal area and an equal volume for the compensation and for the store reservoirs?—Yes. The reservoir capacity is, in the appropriated area, the Barden reservoir, 440 millions of gallons, and the Chelker reservoir 250 millions of gallons, making together 690 millions of gallons of reservoir capacity which are provided in that valley. The capacity of the compensation reservoir is 633 millions of gallons, and the compensation reservoir is placed entirely under the management of the mill owners, so far as the drawing of the water is concerned, and as a matter of practice they draw only from that reservoir during dry weather, when the river is so low that they find it necessary to take more water for their mills. The capacity of the Grimwith reservoir is just equal to 90 days consumption of the water to be brought to Bradford at the rate of 7,000,000 gallons a day, and the mill owners could, if the reservoir was only filled once in a year, draw for 90 days continually from the reservoir as much water as is taken from the district; but the gathering ground is very high, it varies from 1,000 to 1,800 feet above the level of the sea; the rainfall is considerably above 40 inches per annum, and the gathering ground is so large that four inches of rain from that gathering ground will fill the reservoir once. As a matter of fact the mill owners can draw very much more than the quantity which is brought to Bradford, as they can depend upon the reservoirs being filled much oftener than four times throughout the year; they can draw without any difficulty about 20,000,000 gallons a day for 90 dry days of an average year.

8871. Is the Grimwith reservoir in operation now?—Yes, and it has been for three years.

8872. Is the Barden reservoir also at work?—No, that is not; a very considerable amount of work has to be done there yet.

8873. Is the Chelker reservoir also in use?—It is just coming into use, it has not been used yet.

8874. Is the Silsden reservoir in use?—Yes, that is in use, but it is in the other valley.

8875. Where is the Doe Park reservoir?—It is just at the end of the deep purple colour which you see on the map.

8876. Near to Denholme?—Yes, it is. The compensation water given to the Wharfe for the water taken from the river is very ample, and the river has certainly been improved by the works which the corporation have carried out in that district.

8877. Do the whole of your works supply by gravitation, or is there any pumping?—They are all gravitation works.

8878. What is the rainfall over the entire district?—We estimate it at from 34 to 36 inches upon an average of years, probably 36 inches would be a fair average to take.

8879. Were you at all troubled for water last year?—No.

8880. Do you know what volume of water is being brought to Bradford now?—We use about 4,500,000 gallons a day.

8881. How much of that do you sell for manufacturing purposes and how much for domestic purposes?—That is a matter which is very difficult to distinguish in many cases, but we estimate that 1,500,000 gallons are used for the domestic supply, and about 500,000 gallons for public purposes, street watering, and so on, taking the year round, and we estimate that the remainder consumed is used for trade.

8882. How much per head do you reckon that the 2,000,000 gallons give for town purposes?—About 16 gallons per head.

8883. Is that in your opinion a sufficient quantity?—As a matter of fact we find that that is as much as people use; there is no limit placed upon the quantity that they use.

8884. What is the pressure under which the water is supplied in the borough?—The levels vary as much as 600 feet, we have that difference of level between the highest and the lowest parts of the town.

8885. I suppose you break the pressure at intervening points?—Yes, we supply the borough with water at two different levels.

8886. Then the greatest practical pressure is about 300 feet, I suppose?—Yes; but there are points where it is about 400 feet, then again there are some points where it would be practically nothing. We carry the water as high as it will go up the hill sides, and the great bulk of the supply is brought to the town at about 200 feet of pressure.

8887. Do you know the amount of the annual rental received for domestic purposes?—No, we have not separated the figures in that way.

8888. Can you give me the amount of the annual income received for trade and domestic purposes?—I know that the revenue has very much increased from the sale of water. The gross revenue for last year 1865 was 22,344*l.*

8889. And it is increasing?—Yes, it is increasing very rapidly; in the year before the revenue amounted to 19,416*l.*

8890. What do you charge per 1,000 gallons for water supplied for manufacturing purposes by meter?—Our scale of charges varies from 2*d.* per 1,000 gallons to 1*s.* per 1,000 gallons, that is to say, for the smallest quantity that is used we charge at the rate of 1*s.* per 1,000 gallons, and we sell it at 2*d.* per 1,000 gallons to persons who take a sufficient quantity; but

the truth is that we have not yet had customers who took enough water to bring down their charge to that end of the scale.

8891. (*Professor Way.*) In point of fact you do not sell it for 2*d.* per 1,000 gallons?—No; I believe that the largest consumer has paid us from 600*l.* to 700*l.* a year for water, he being charged at the rate of 2½*d.* or 2¾*d.* per 1,000 gallons. For trade purposes we sell it by meter.

8892. What is the gross amount of capital that is invested in your waterworks?—The gross total of the capital account is 739,609*l.* at the present time, but that includes many items which would hardly form part of the expense of carrying out the water scheme, because it includes parliamentary charges, the purchase of old works, and all the usual items.

8893. What is the estimated cost of completing your works as the scheme stands?—It is rather difficult to say, but I estimate that it will take at least 50,000*l.* to complete the whole of the undertaking.

8894. And that will give you only 10,000,000 gallons a day?—Yes.

8895. For the purpose of sale?—Yes.

8896. And exclusive of compensation?—Yes.

8897. If you could sell 10,000,000 gallons at 2*d.* per 1,000 gallons, would that answer your purpose?—That would hardly do for us; but of course the average rate that we receive for the water that is sold by measure is very nearly 6*d.*, according to the scale at which we sell it.

8898. Still you think you gain an advantage in offering a premium to trade and selling the water at the lowest possible rate that you can?—Yes, we think it is an advantage to do so, because unless we sold the water at a very low price we should not be able to sell a large quantity.

8899. It is upon that principle that you act?—Yes; we do not sell all our water at that price.

8900. In what condition is Bradford beck now?—The beck is in a very bad condition.

8901. To your knowledge is it the practice of any parties, either within or without the borough, to pass solid refuse into the beck?—I cannot say much as to particular persons, but I know that it is done.

8902. Have you, as engineer to the borough, any authority to cause the matter to be looked after and to forbid the practice?—No, I believe not.

8903. Is the beck, in any portion of its course within the town, in an unregulated state; that is to say, the banks not fenced off nor walled, nor the bed pitched?—It is altogether in a very unsatisfactory condition. I have indicated on this plan the manner in which the Bradford beck and its tributaries run through the town.

8904. I assume that you can put this plan in?—Yes. There are several minor streams besides the Bradford beck which pass through the thickly populated part of the town.

8905. The plan which you have put before the Commission shows the town of Bradford and the lines of the Bradford beck and its tributaries?—Yes.

8906. Are the tributaries or is the beck in any portion of their course built over?—Yes. The Bradford beck, as you are aware, is a tributary of the river Aire. It joins the river Aire two miles below Bradford, at a place called Shipley. The beck flows through the middle of the town, and extends about six miles to the west. The minor streams which flow into the Bradford beck, which you will see upon the plan with the names written upon them, are smaller than the Bradford beck, but are of a similar character. The water-shed area of the Bradford beck and its tributaries is 11,000 acres at the boundary of Bradford, and to its junction with the river it is 14,660 acres.

8907. Have you any gaugings of the volumes of water in dry weather and in flood?—No; there are several towns and villages in the valley of the Bradford beck besides Bradford. There is the town of Thornton, and there are Heaton, Allerton, Clayton, and a part of Queensbury. All except Heaton are above the borough of Bradford. The beck course through the middle of the town for nearly a mile in length is practically all covered over, chiefly by buildings, and in this way it has become very much obstructed and very much interfered with. It has been the practice of owners throughout Bradford to claim the soil of the beck channel, and in erecting buildings near the beck to build over or in the beck. In many cases the land on each side belongs to different owners; they each claim to the middle of the stream, and on building they have put down the outer walls of their buildings at the boundary of the property, which is in the middle of the stream, and the result of that is that for considerable distances the beck is divided into two streams, and the flow of water, especially during floods, is very much interfered with.

8908. Within your knowledge have serious injuries arisen from floods in many parts of the town?—Yes.

8909. Can you at the present time name the dates and the circumstances?—I have not the particulars here just now, but I shall be able to give them to you; but I think that it is four years since the last occasion when the town was inundated with water. The new sewers which have recently been made, especially the large outfall sewer, have to a great extent tended to prevent flooding in the town.

8910. As an engineer do you think that, if the corporation had power and had funds, it would be possible materially to improve the condition of the beck as regards purity and a freer delivery of water?—I think that it would be possible to improve it very much indeed. In fact, in the report which I made to the committee with reference to the sewerage of the borough, I suggested a mode in which they should deal with the Bradford beck (*the witness delivered in the same*).

8911. Is it a fact that the Bradford beck is notorious in Yorkshire for its amount of pollution? Have you ever heard it alluded to as an exceedingly polluted stream?—Yes, I believe that it is so.

8912. People have begun to say, "as polluted as "the Bradford beck?"—Yes, it is in a very bad condition. One peculiarity of the Bradford beck is that there is at times a large body of hot water flowing into the stream, and it seems to have the effect of making the smell more offensive. Condensed water is cast into the beck and boilers are also emptied into it. There are other obstructions placed in the beck besides the building of walls in it. In some cases weirs or dams are placed across in order that the mill owners may obtain supplies of water; the principal obstruction in the beck is the sluices or cloughs which are placed across the beck by the canal company. They raise the water from three to four feet at a point at the lower side of the town, so as to create a pool of a sufficient elevation to run into the canal. That makes a very serious obstruction, especially in flood time, and the result is to cause the channel to silt up and also dirt to deposit to a very serious extent.

8913. What is the condition of the Bradford canal?—The Bradford canal is the worst stream of water which it has been my fortune to meet with or hear of. It is very much worse than the Bradford beck. The canal is entirely supplied at the end of this branch from the water of the beck. That water becomes very much worse than the water in the beck, for the simple reason that the water is penned back by the canal locks for a sufficient length of time to allow the filth in the water to decompose, and in dry weather the water becomes very foul. I have no doubt that the effect upon the health of the town has been very prejudicial.

8914. Have you heard any talk of doing away with the canal?—Some legal proceedings have been taken during the last two years against the lessees and the canal company together for the purpose of suppressing

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the nuisance, not for the purpose of doing away with the canal. The gentlemen who are concerned in that prosecution would be glad to attend before you and to give you the result.

8915. Will you describe to the Commission the character of the works situated on the river Aire?—The waterworks in the valley of the river Aire consist of three separate parts. First of all, there are the old works which the Manywells springs supply, viz., two store reservoirs at Chellow Dean, and a compensation reservoir near the Manywells springs called the Hewenden compensation reservoir. Those works constitute the old scheme from which the town was formerly supplied with water. Then the new works are divided into two portions; the low-level portion consisting of 11½ miles of main and intercepting conduits, and containing the Silsden compensation reservoir; and the high-level portion in the most southerly districts, consisting of the Stubden store reservoir and conduit and the Doe Park compensation reservoir. The area of the gathering ground in this valley which is appropriated for the supply of the town by the new works is 3,100 acres. As to the old works, the supply being exclusively from a spring, it is not practicable to give the area of the gathering ground, but the volume of that spring is equal to 500,000 gallons per day. The area from which the compensation water is drawn in the low level is 2,000 acres, in the high level it is 1,000 acres, with the overflow from 900 acres, the extent of the appropriated area. As regards the old works, the Hewenden compensation reservoir has an additional area of 1,000 acres, with the overflow from the area of the Doe Park reservoir. The Silsden reservoir is used in a different manner from the other compensation reservoirs. It is provided in the Act of Parliament that 1,350,000 gallons a day shall be discharged all the year round as a compensation for the water which is brought to Bradford from that district. The quantity of water brought to Bradford from that district is 1,500,000 gallons per day, so that the river is not very much affected by it, either in one way or the other. The capacity of the Doe Park reservoir is 110,000,000 gallons, and the quantity of water brought from that district to Bradford is 1,000,000 gallons per day. The quantity of water, therefore, is equal to 110 days supply.

8916. That requires the reservoir to be filled once in every 110 days?—Yes; that is assuming that there will not be more than 110 dry days consecutively in the year. The capacity of the Hewenden reservoir is 70,000,000 gallons, and the quantity of water taken to Bradford is 500,000 gallons per day. Therefore the compensation water is equal to 140 days of the town supply. These reservoirs are worked in the same way as the Grimwith reservoir under orders from the millowners, and the millowners draw from these reservoirs at least 2,000,000 gallons per day throughout the year.

8917. Do the millowners pay for the management of the reservoirs?—They do not.

8918. You pay for the management, and they control the draught?—Yes, and we also pay for the maintenance. You will observe that that 2,000,000 gallons per day which the millowners draw from the Hewenden and the Doe Park reservoirs is greater than the quantity which is taken from the district to Bradford.

8919. As engineer do you know whether the volume of water thus given for compensation, is the usual proportion given for compensation, or is it more or is it less?—I think that it is more than is usually given for compensation. The compensation water, so far as I understand it, is generally based upon 120 days' supply of the water taken from the district.

8920. Have you an analysis of the water from the several reservoirs?—No. We have some analyses which were made formerly before the works were completed.

8921. Is the Grimwith reservoir in good working order?—Yes.

8922. And the Doe Park reservoir?—Yes, they never were better.

8923. Are they both full, or nearly full, at the present time?—Yes, in fact they have been full during the greater part of this year, it having been a very wet year.

8924. Then the Doe Park reservoir has been full since we saw it last?—Yes, and it has been so for several months.

8925. And you have your registration as to the yield of the drains, both within the culvert and without?—Yes; the yield is less than it ever was before, in fact the reservoir is in every way in a better condition than it ever was before.

8926. You feel satisfied now that the difficulty in that respect has been overcome?—Yes.

8927. What is the name of the reservoir where the valve well was being repaired?—That was the Grimwith reservoir.

8928. Is it in good order?—Yes.

8929. You have effectually completed it?—Yes, and it has been working nearly the whole of the year. It was not a very long job to complete it.

8930. You have the means of drawing that reservoir down at two heads?—We have.

8931. And the Doe Park reservoir at one head?—Yes.

8932. At what point of the Bradford beck have the most injurious proceedings taken place?—As you will observe, there is a limited district. You will see upon the contour plan that there is a very limited area at the lower part of the part marked green, before you come to the yellow, which is the lowest part of the town. The whole of the lowest part of that green basin has been filled with water from the higher lands. I have seen the water myself as much as two to three feet deep in the streets hereabouts.

8933. Have you had any opportunity of gauging the volume in dry weather, and also in floods?—In dry weather we might gauge it, but it would not be easy. It would be difficult to find a point where you could collect all the water.

8934. Have you gauged the delivery of your outlet sewer at any particular period?—No; it is in a mere transition state. We are daily connecting new drains and sewers with it.

8935. Have you any idea what volume of water is flowing to the outlet?—I should think that it is now equal to nearly 5,000,000 gallons a day.

8936. Then, if you had to deal with the sewage for irrigation, you must contemplate dealing with a volume of water equal to 5,000,000 gallons per day?—We must contemplate much more than that.

8937. I mean even at the present time?—Before 10 days are over it will be more. We shall attach some new sewer, the work being in progress.

8938. In draining your town do you meet with much subsoil water in trenches which you excavate for sewers?—Only at intervals. The principal water with which we are troubled is that which flows from the old sewers which the new ones have to replace, otherwise we do not meet with much subsoil water. But the subsoil is to a great extent rock, and the water which drains from the higher lands comes out more distinctly like springs than it would do if the subsoil were of a more porous character.

8939. Your sewage would bear some proportion to the volume of water passed into the town for domestic and manufacturing uses?—It does not, I think, bear a proportion to it, because a great deal of water is pumped at the mills and by different persons in trade, and is drained off into the sewers, which water does not come through our mains.

8940. Then it would be difficult to estimate the volume of water in the sewers except by gauging at the outlet?—Yes, and the works are still incomplete. I think that the volume of drainage in that sewer when the works are completed will not be less than from 15,000,000 to 20,000,000 gallons a day.

8941. At the present time is the foul water from the works situated within Bradford generally passed into the beck or into the sewers?—We have taken into the sewers all drains and sewers of every description with which we have come into contact, and when the drains are completed no doubt a very large proportion of foul water will come into the sewers.

8942. Do you think that you will take no refuse dye water?—All water which is taken from the becks to be used for trade purposes must be returned by those who take it to the becks. I do not therefore think that the dye water will find its way to the sewers.

8943. Have you stipulations put upon manufacturers that they shall return to the beck as much water after use as they have taken out of the beck?—I do not think that there are any stipulations, but it is understood that they shall return it to the stream, otherwise the stream would be dry, there would be no water in the becks long before the becks got through the town.

8944. Have you a report upon the main sewerage?—That is the one which I have handed in. That report shows the scheme upon which we are now working, with some very slight modifications of level which have been shown to be necessary in practice.

8945. Are your sewers systematically ventilated?—The only arrangement which has been made so far for ventilation is to connect the vertical rain pipes of buildings with branch drains leading to the sewers without the intervention of traps.

8946. Do you think that that is sufficient?—I do not; but at present we are hardly in a condition to carry out any other system. It is not intended to ventilate the sewers upon that system.

8947. Do you not think that it would be expedient to have temporary ventilation at the upper ends of your sewers?—We have not yet got to the upper ends of them.

8948. But you could introduce means for the escape of gas at that point, and that would be better than to allow it to accumulate and force its way back into the dwelling houses?—I do not think that there is any escape of gas into the dwellings as yet, the flow of the water as compared with the size of the sewers is very small.

8949. But you are aware that the gas being lighter than atmospheric air rises to the highest point?—Yes; we have a great many openings by which such gases can escape into the vertical rain pipes of buildings; probably the draught caused by a flue would not extend to any great distance in the sewer.

8950. (*To Mr. McGowen.*) Have you any officer of health?—No.

8951. Have you discussed the propriety of appointing an officer of health?—Not since I have been here.

8952. Have you any inspector of nuisances?—We have two inspectors of nuisances with a very efficient staff.

8953. Shall we have them tendered here to give evidence?—Not unless you wish it. Our notion was that all the details upon physical questions affecting the town were in the possession of the engineer, but the inspectors are at your service with great pleasure, if you wish to see them, and the chairman of the sanitary committee would be happy to come before you.

8954. We should be happy to see them.—One of the inspectors of nuisances has been in attendance this morning in case he should be wanted, and in fact he is here now.

8955. (*Chairman, to Mr. Gott.*) If you do not intend to do something more than attach down spouts, my opinion is that the sewers will not be sufficiently ventilated. In my opinion a system of sewers can be under-ventilated, but it is absolutely impossible to over-ventilate them?—Certainly. We have had under consideration the subject of ventilating the sewers. The plan adopted in London, and in some other large towns, of making vertical air shafts from the top of the sewer to the surface of the street, to allow the draught from the sewers to escape into the street, appears to me to be open to so many objections, that I have not recommended the council to adopt it in their works. The general objection appears to me to be, that if the air and gases in the sewers are foul, and if the smell is offensive (which it must be at times), it must be very objectionable to direct that smell into the street, where it would be most likely to contaminate the air. If the air from the sewers is offensive on entering houses by means of internal drains and openings, it appears to me to be equally offensive on entering houses from windows and doors. There is another objection, namely, that the hot water and steam in the sewers in Bradford is known to be of such a character that we think that if we had these openings they would be dangerous, the steam constantly arising from them would make it dangerous to horses going along the street. The mode which I propose to recommend our committee to adopt, is to obtain some general power which will enable them to arrange with private persons for the formation of a chimney shaft or flue in the corner of a house or other building at proper and suitable intervals along every street, and that those shafts should be connected with the sewer, and continued to a sufficient height above the tops of the houses to prevent the smell blowing into any of the windows. The flues would not require to be larger than the ordinary chimney flues, and if the highest buildings were selected it appears to me that the smell would be carried off in a less objectionable way than by the other mode.

8956. The very excuses which you have offered for not ventilating the sewers are in my opinion the strongest reasons why they should be ventilated without the least possible delay, namely, the existence of the steam and the hot water. Any temporary nuisance by the steam rising into the street, as you say it would do, in my opinion would be as nothing compared with the risk of contamination if the gas is enabled to force itself along and get inside dwellings. Then, as to the dilution of the gases by permitting them to escape directly from the crown of the sewer into the open air, all chemists and scientific persons know that the dilution is in proportion to the cube of the space, and the escape into the streets of a very foul-smelling gas would be comparatively innoxious to any human beings dwelling in that town, whereas if admitted in a high state of concentration into the four corners of a dwelling it might be of a most dangerous character. Any admission by doors and windows would be trifling in comparison. London is notoriously the most healthy town in the world, and the opinion is that its health has arisen from that cause. Over the west end of London you can count the waterclosets by tens of thousands, above 1,500 miles of the sewers of London are sewers of deposit which have to be cleansed by hand, and the evaporation from that deposit must be enormous; but still, by diluting those gases in the atmosphere external to the buildings, you reduce the rate of mortality until you see it ranging from 22½ to 23½ per thousand. I do not know what your mortality is here, but in Manchester, in Salford, in Leeds, in Sheffield, and in Liverpool it ranges from 30 to 35 in the 1000, and in the last year in Liverpool it has been up to the frightful amount of upwards of 60 in the 1,000?—What I said was not to excuse the non-ventilation of the sewers, nor in any way to obviate the necessity of ventilating them, neither did I wish to give the opinion that they ought not to be ventilated; what I said was more in reference to the manner in which they might be ventilated. I quite agree with you as to the necessity of ventilating them.

(*Chairman.*) If you assure me that you and the corporation will put up your tall chimnies with the least possible delay, I will accept that, but if not, I would urge you by all the power of my language to introduce a surface ventilation in the streets, at the

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risk of any supposed inconvenience which might arise from letting out those gases into the open air.

8957. (*Professor Way.*) The Chairman does not say that it is a good thing to discharge the gases into the streets, but that it is much better to discharge them and dilute them in the streets than to deliver them in the dwellings. If you can propose any method by which you can not only keep them out of the dwellings, but can keep them out of the streets, of course that is a desirable thing?— But, at the same time, I think that anybody will see that one of those grates taken by itself cannot be made more than the equivalent of a vertical drain of a house.

8958. If I understand him rightly, the Chairman was not objecting to your system of ventilation, but was objecting to non-ventilation?—I rather took him to object to our system as not being sufficient.

8959. (*Chairman.*) I unhesitatingly say that the down-spout ventilation is not sufficient?—It is not perfect.

8960. (*Professor Way.*) 10 per cent. in ventilation is better than one per cent.?—No doubt; it is only a question of quantity.

8961. (*Mr. Harrison.*) It has been stated in other towns (and I believe that it is very likely to be the case) that the ventilation which you speak of by spouts becomes inoperative just at the very time when it is wanted. If there is an extra rainfall which is likely to fill your spouts with water, and to hold the gases for a longer time, the water coming down the spout holds its own. There was a medical man at Croydon who illustrated that in a remarkable manner. He said, "On the occasion of a thunderstorm I heard "a great noise in my house; I went up to the water-"closet, and found the gases bubbling through the "watercloset, and at the same time there was an "extremely bad smell, and in a few days I had fever "in my house, and it went through the servants and "the children?"—That would be very exceptional. At the same time, if the system is open to that objection, the other system is open to this objection, that in frosty weather you have no alternative but to confine the gases to the sewers, and let them escape where they can.

8962. (*Professor Way.*) Do the openings ever close?—Yes.

8963. (*Chairman.*) They never do so in London?—London is a peculiar place, but further north you will find it to be the case.

8964. (*Professor Way.*) You will always see an opening into the street, whether there is snow or not. However, you wish the Chairman to understand that there is always the means of some ventilation?—Certainly.

8965. (*Chairman.*) Have you a tabulated return of the death rate?—We have the returns tabulated for each year. The death rate for last year was 28 per 1,000.

8966. How far back can you give us the death rate?—I think that I have it for eight or ten years.

8967. Will you give it to us in round figures for 10 years?—I have just given you the death rate of 1866.

8968. Will you begin with 1856, or with the earliest date with which you can begin?—I can begin with the year 1861. The death rate was then 27 per 1,000. In 1862 it was 24 per 1,000. In 1863 it was 26·2 per 1,000; in 1864 it was 28·3 per thousand; in 1865, it was 28·5 per 1,000; in 1866, it was 28·2 per 1,000.

8969. Then the mortality of Bradford may be taken as standing at about 28 per 1,000?—Yes.

8970. Have there been any reports published by a local sanitary officer connected with the corporation?—Yes, the report for 1866 is not printed in our usual form, but I have it in a newspaper form. I can deliver in reports dating back to 1860. (*The witness delivered in the same.*)

8971. Are there any further remarks which you have to make?—As to the outfall of the sewers, I think that you did not quite exhaust that subject.

8972. What is the diameter of your main outfall sewer?—8 feet 6 inches.

8973. It is circular?—Yes.

8974. Have you ever calculated what volume of water it would require to fill it?—Yes.

8975. What is the fall of the outlet sewer?—1 in 400.

8976. That is about 12 feet per mile, is it not?—Yes; I make the discharge of the sewer 32,000 cubic feet per minute.

8977. That would be about 80,000,000 gallons in a day?—As you are aware it is a valley line, and is subject to a very great increase of water from floods.

8978. At any rate you have no fear of bursting the sewer?—No.

8979. You calculate that it will take storm waters?—Yes, below that point the sewer is much smaller; it is the earliest point at which we can get rid of the storm waters.

8980. In the event of your having to convey the sewage proper for irrigation, it would not be necessary to make a conduit in that situation?—Certainly not. The situation of the outfall at present is a temporary one, and it is made at the point nearest to the town where we can lead the excessive flood waters into the streams; it is about half a mile below the town in the valley. From the point which we have selected, which will ultimately have to be made the situation of the permanent overflow, the sewer will be 4 feet 6 inches in diameter.

8981. Have you seen any of the sewage outlet tanks, as at Birmingham and at some other places, where the sediment is taken out of the sewage before the affluent water passes into the stream?—Yes; I have seen the Birmingham works.

8982. Would you have any difficulty in carrying out such a regulation for Bradford?—I think that we should. It is very difficult to find a place here where works of that kind can be established. The valley is very thickly populated, and the population is chiefly a trade population. There would be no means that I am aware of, of getting rid of the solid matter taken out of the sewage, unless it was carried away by railway or canal.

8983. Then do you think that you are permanently condemned to pollute your river?—No; but I do not think that the sewage, if dealt with here as it is dealt with at Birmingham, would be either so profitable or so useful to us as it is at Birmingham.

8984. Do you think that before a town should be required to get rid of pollution it should be necessary to make a profit upon it?—No, not at all.

8985. What does a penny in the pound upon your rates produce?—About 1,450*l.* It has increased very much of late.

8986. Then 1*d.* additional upon the rates would give you 1,450*l.* additional to work with?—Yes.

8987. Do you think that that would be ruinous to the trade of Bradford?—Perhaps not.

8988. Have you seen the mode of irrigation at Croydon?—I saw it some years ago. I have not seen it in the last few years.

8989. You have not seen irrigation at South Norwood?—No.

8990. Or at Worthing?—No.

8991. Have you seen the Edinburgh meadows?—No.

8992. Have you seen the irrigation at Carlisle?—No.

8993. Have you seen the sewage tanks at Blackburn?—Yes.

8994. When did you see them?—Within the last four or five months.

8995. They have made some additions to them since then?—Probably so.

8996. Could you do anything of that sort at Bradford?—I hardly see how we could deal with so large a quantity of water as that which we should have. Those works seem to be on a very small scale; the difficulty really is in finding a locality in which to do

it. The valley is very narrow all the way down below Bradford. Before you get two miles away from Bradford you get to Shipley, and the intervening district is occupied to a great extent with suburban residences, and is altogether of a character where it would be extremely difficult to work any large scheme for changing the character of the sewage.

8997. Do you know what your 4-feet sewer costs you per linear yard?—The sewer itself would cost us about 30*s.* per linear yard, but the easement would of course depend upon the locality through which it had to go.

8998. If it cost you 2*l.* a linear yard complete, how much would it cost per mile?—4,000*l.*

8999. Then if you had to go 10 miles it would cost you 40,000*l.*?—Yes.

9000. From your answer I presume that it is a question upon which you have not made any detailed estimate?—We have not. We commenced our sewage works in 1863, and our attention, so far, has been entirely directed to the town sewers. Of course we must collect the sewage from the town and take it into the sewers, and as soon as we have done that we shall have to consider what we shall do with it.

9001. Have you thought at all upon the question of a conservancy board for the management of the rivers?—Yes, I have thought a little about it, simply from reading what has been said in other places.

9002. What idea have you formed as to what kind of board it should be?—I can hardly say that I have formed an idea at all. There are a great many interests to be taken into account, and no doubt the duties of the board would be very complicated. So far as the natural watercourse passes through such a town as Bradford, probably the best way would be to invest the local body, namely the corporation, with sufficient power to deal with that part of the stream. As to the general result it would be comparatively useless to improve one stream, such as Bradford beck, unless some comprehensive scheme was adopted; and the management in that case of course would have to be vested in the hands of a body having rights and powers to deal with the whole district.

9003. Seeing that Bradford beck has been in a great measure built over, how would you now undertake to improve it?—I do not see any other way of improving it than by the corporation (at the cost of the town, if necessary) taking entire and exclusive possession of the beck, and making a new channel for the beck, paving the bottom of it, and making side walls and so on; and making other provision for the buildings which stand upon it.

9004. Have you seen the recent alterations which have been made in the rivers passing through Blackburn and Bolton, with regard to paving and pitching?—I have seen them in Blackburn, but not in Bolton.

9005. You are aware that both those towns stand on becks like your beck?—Yes; it is a matter which is very easy to be done before the surface of the beck is so completely occupied as in Bradford.

9006. Do you think that, for the future protection of the beck, it would be a wise provision for the corporation to obtain powers to regulate how buildings shall be erected, with regard to the beck, in the same way as you can regulate buildings in streets and other properties?—I think so, in the interest of the town alone. The town suffers very materially from these obstructions by the water overflowing and damaging warehouses and goods in the lower part of the town.

9007. Do you know anything of the recent borough improvements by forming new streets?—Yes.

9008. Do you know the amount of capital which you have borrowed for that purpose?—Yes; 154,264*l.* has been obtained for street improvements.

9009. Is that the money actually borrowed?—Yes.

9010. Do you know to what extent you have authority to borrow?—200,000*l.* is the present limit.

9011. I think that you have had two sanctions from the Secretary of State of 100,000*l.* each?—Yes.

9012. And you have not availed yourselves of that power, except to the extent of 154,000*l.*?—We are constantly borrowing, that is the extent to which we have gone.

9013. Have you any idea of the amount which the corporation expect to be repaid by the sale of land?—I should think that at least half of it will come back again, and probably more.

9014. You have acquired large plots of land which will be available to recoup some of the money?—Yes; I have no doubt that more than half of it will come back again in the way of resales.

9015. Do those street improvements increase the value of the frontages upon the land which has been left when the street has been opened out, as well as facilitate the trade of the borough?—Yes. One great advantage of taking the whole property in the way in which the corporation are doing it is, that it enables you to clear the ground for new buildings. It is common in many towns, in the old parts of the town, for the buildings to be so mixed up that no single owner can take down his building and erect a better one in the place of it without interfering with some rights, so that in no other way than by the practice which the corporation have adopted could sites be obtained for building in the new streets.

9016. Are you aware whether any further extension of building is contemplated when you have finished what you have in hand?—Yes; the provisional orders which the corporation have obtained extend to a great deal of property besides what they have already dealt with.

9017. Beyond the property which you have scheduled, have you any idea of making improvement?—That is a question which I can hardly answer, it of course would depend upon the general policy of the corporation afterwards.

9018. Has there been much grumbling in Bradford about these street improvements?—I do not think that there has been any grumbling, except that the inhabitants generally think that the corporation have not done enough. I am not aware of any other grumbling.

9019. (*Mr. Harrison.*) What is the area of the Bradford beck basin above the borough of Bradford?—It is difficult to say exactly, but I think that about half of the 11,000 acres will be found to be above the town, those 11,000 acres include the borough.

9020. So that the water supply formerly to the beck would come from about 5,000 acres, besides what was pumped below?—Yes, and the unoccupied and agricultural parts of the borough.

9021. In the water schemes which have been carried out is any water taken from the area of the Bradford beck basin?—None at all.

9022. Will you state the areas of the other watersheds which you take for your town water supply, quite independent of the compensation reservoirs?—I can give you the water-shed areas in the valley of each of the rivers.

9023. For instance, take the Barden beck?—We take the whole of that.

9024. That is 5,690 acres, is it not?—The Barden beck area is 2,610 acres, the 5,690 acres is the area not only of the Barden beck but of all other becks appropriated or included in the area; the catchment basin of all that goes to the reservoir is 2,610 acres.

9025. Do those streams come to your town supply?—Yes.

9026. The area for the town supply from the Barden beck district is 5,690 acres?—It is.

9027. The next reservoir is the Chelker reservoir, that is 1,860 acres?—Yes.

9028. Below that what is there?—Below that there is 2,220 acres.

9029. What is the area on the south side of the Aire from which you collect water for the supply of the town?—900 acres.

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9030. Will you be kind enough to add up those amounts and see what the quantity is?—I make it 10,670 acres.

9031. Then the area from which you obtain water beyond your beck is larger than the area of the beck itself within the borough and about the borough?—It is about the same, namely, 11,000 acres.

9032. About what is the rainfall in the district?—We estimate it at 36 inches.

9033. What do you consider to be the evaporation in this neighbourhood?—Of course from that area we raise a great deal of water unfit for town use, owing to the floods.

9034. Do you consider that you will be able to obtain from that area about 10,000,000 gallons a day steadily?—Yes.

9035. At present you take about 4,500,000 gallons?—Yes.

9036. And for that you say you receive about 22,000*l.* a year?—Yes.

9037. How much does that give you per cent. upon the capital which you have expended?—About three per cent., I think, or a little over.

9038. And you have 5,500,000 gallons a day still to dispose of?—Yes.

9039. The town you say has a constant supply?—Yes.

9040. Do you expect to have a demand for that remaining 5,500,000 gallons a day?—Yes, we think so, in the course of years; not an immediate demand.

9041. What will that demand be chiefly for?—For the development of the trade, and for selling in the neighbourhood.

9042. You have mentioned that there are about 1,500 waterclosets at present discharging into your sewers?—Yes.

9043. But it appears that there are about 14,000 privies in the district?—Yes.

9044. Therefore you have not as yet connected the houses to any very great extent with your sewers?—No; the practice of the corporation so far has been not to encourage the adoption of waterclosets, especially in small houses, partly on account of the imperfect character of the sewerage of the borough, and partly from the want of water; that has been the practice in previous years.

9045. But when you obtain this larger supply from the reservoir at the wharf, will you connect all the houses with the sewers and encourage waterclosets to be erected?—No, I can hardly say that. I do not think that there is any intention to do that.

9046. Then is it the intention of the corporation to encourage the continuance of the system of cesspools and privies?—So far as all the legislation connected with Bradford has gone the corporation have no power to do anything else than to allow the erection of ashpits and privies.

9047. They have no power to compel their removal?—No, nor to prevent their erection.

9048. You have power to control their erection?—Yes, as to their number and where they should be.

9049. It is a point of great importance. If there are 14,000 privies still to be connected, and if they should be connected, the nuisance which is acknowledged now to be great from the sewage would be immensely multiplied?—There is no doubt of that.

9050. Therefore the argument would be, that if a large quantity of water is to be brought to a place like Bradford, some provision should be made as to what is to be done with it after it has passed through the sewers?—Certainly. In fact it is the practice now in all cases, large or small, even if they have waterclosets, to have a privy and ashpit erected; it is almost universally done in Bradford. All these ashpits are drained, so that the liquid from them at present finds its way to the sewers.

9051. The expense of removing the contents of all those ashpits you say is now about 2,700*l.* a year?—Yes, for emptying them.

9052. What would it be if there were waterclosets established, and if you had merely to remove the ashes, would the corporation be obliged to do that?—I think that it would still have to be done by the corporation.

9053. What would be the expense of doing it?—I should think that it would not be very much diminished. Of course the ashes in that case would have no value; there would be no return which a contractor could obtain by the sale of them.

9054. And at present they have a value?—Yes, at present they have some value.

9055. I do not think that you told us exactly what proportion of money you received from the trade and from the house supply;—No, I was not able to tell you that.

9056. I see that in your list of charges you charge so much for a bore of a certain size for the supply to a house?—Not at all; that is only for trade purposes where water is supplied by meter.

9057. How do you manage it at different heights, the water must be at different degrees of pressure?—Certainly; the pressure varies in different parts of the town.

9058. These charges are all by meter?—Yes.

9059. Can you state how many manufacturers you supply with water at the rate of 11,000 gallons a day, which I see is about 6*d.* per thousand gallons?—I cannot do so now, I can only tell you by referring to the book. I have not the information at hand.

9060. I should be glad if you could give us that information?—I will prepare that information for the Commissioners.

9061. Does it not appear desirable that when Parliament grants powers to a town situated like Bradford, for bringing a large quantity of water to it, the question of what is to be done with that water after it passes from the town should be considered at the same time?—Probably it might be a matter for Parliament to inquire into, but so far as the town is concerned the water cannot do any harm; it must improve the condition of the waste water which is the ultimate result from the town.

9062. Bradford appears to be dependent for its extension in a great measure upon the water supply?—Probably so, indirectly. I should think that the trade of the town would have extended whether the water supply had been brought or not; that is to say, that private individuals must have found water in some other way for themselves if the corporation had not done it. No doubt it makes the town more convenient, and it is an encouragement for trade to settle in Bradford, because there is a copious supply of water.

9063. Do you not think that the extent of the town would have been limited if it had not obtained the large water supply which it has obtained from a distance?—It is very difficult to answer that question.

9064. Would it not have been easier to get rid of the sewage than it is now. That matter you represent as being a serious difficulty, in consequence of the large population, and the small district in which it is contained?—Yes; I think that you will find from the population returns that the town increased quite as rapidly before the waterworks were established as since, perhaps more so.

9065. (*Professor Way.*) We were told that the increase of population was not to be taken in reference to the increase of manufactures?—I think not.

9066. (*Mr. Harrison.*) Can you give any idea of the quantity of water which is used per head per day by the poor of Bradford?—No, I do not think that I can give you any nearer estimate of it than you have already got, of 15 or 16 gallons per head per day. No restriction whatever is placed upon the quantity of water which they use, they can draw whatever they choose, and they do not pay either more or less, whether they use much or little.

9067. Have you the means of separating any portion of the town which is inhabited by the poor, so as to see what quantity of water you supply to that population?—I hardly think that there are such means. Probably we might find a district which would include a score or 40 or 50 houses.

9068. Is there no ground down the valley of the Aire, between this town and Leeds, to which the sewage might be applied?—I do not think that there is any appropriate land between Bradford and Leeds, there is none that I am aware of. The valley down to Apperley Bridge and below Apperley Bridge is a valley occupied for suburban residences. There are several villages all the way down.

9069. If you pumped your sewage, is there any land in the neighbourhood to which the sewage could be applied with advantage?—The hill sides all have a very rapid descent. I do not know of any district where the sewage could be taken with advantage until you get to some distance below Leeds.

9070. What do you recommend the corporation to do with their sewage?—As I have already explained, that is a point upon which we have not yet arrived at a conclusion. It partly depends upon the information which we obtain from other towns, and probably upon the result of your present inquiry, as to what may prove to be practicable in cases like ours.

9071. You are going on day by day and week by week increasing the pollution by sewage?—We do not consider that we are increasing the pollution in any way whatever, but rather the reverse.

9072. You are putting more pollution into the river?—No; it all now goes into the river, but we are providing new and improved channels through which the sewage of the town will get into the river and in a more rapid way, and certainly there will be a great improvement in the state of the Bradford beck when those works are completed.

9073. But are you not increasing the quantity which goes into the beck?—Not at all.

9074. And you do not intend to increase it?—Not by our sewerage works. No doubt as the town extends the quantity of sewage matter will increase.

9075. Have you any separate returns of the death rate in different parts of the borough of Bradford?—No.

9076. Do you know whether there are some parts more healthy than others?—Yes. No doubt there are several parts which we know to be very unhealthy.

9077. Can you trace that unhealthiness to any distinct cause?—They are the lowest parts of the town, where the houses are very thickly grouped together, and a large number of persons live within a very small area.

9078. Are those the houses where these cesspools exist?—There are ashpits. They are distinct from cesspools. Cesspools are more in the nature of places made below the surface of the ground. These ashpits are places erected above the surface of the ground.

9079. Are there no cesspits at all?—There are very few, if any, cesspools. I am not aware of any.

9080. The unhealthiness you say is chiefly in the lower parts of the town?—Not necessarily the lower parts, but the thickly populated parts, where a great number of small houses are grouped together on a small piece of ground.

9081. And it is not specially where these ashpits predominate?—Not at all. In fact the ashpits are all over the borough, and therefore that hardly could be the case.

9082. (*Professor Way.*) You have spoken about the application of sewage. I suppose that the pumping of sewage is like the pumping of water, namely, a question which can be reduced to a calculation?—Certainly; sewage is rather worse to pump than clean water.

9083. But still it is to be pumped?—Yes.

9084. The question of situation I suppose resolves itself into a question of pumping?—Yes, in some measure.

9085. Mr. Filliter at Leeds told us that he could pump 1,000 gallons of water 250 feet high for a halfpenny?—That I suppose is apart from all expenses of plant and machinery, and so on and no doubt he would have it as a part of a large scheme. I do not know what the cost of the London pumping is, but probably that would be the best criterion to follow, where they actually pump sewage.

9086. Where sewage is formed in a valley where there is a difficulty in getting it into a position in the country where it can be dealt with, is the question of expense so very great that we cannot consider it?—In the first place, it is a question of expense, and of very great expense, and there is then the feeling that whatever is done should not be optional, but should be enforced upon all localities and all towns.

9087. I suppose that *primâ facie* it would be right that people who take water which they find pure, should restore it, if they possibly can, to the community again in a pure state, or as nearly pure as they can?—I think it very desirable and very important that that should be done.

9088. Therefore there is not any great hardship upon the community in declaring it an established principle that people have no business to pour dirty water into rivers?—No, everyone would be glad to see any means by which such a result could be established; and so far as the Bradford corporation are concerned, I have no doubt they would be glad to take any means to obtain such a result. The bringing of pure water at once into a town certainly has the effect of diluting and making less offensive the refuse water from a town.

9089. You had no intention of saying that it was a right and proper thing that because you had the means of obtaining pure water, therefore you should damage your neighbours below you with impure water?—Certainly not. I take the existence of the town to be a fact, and I take the bringing of an additional quantity of pure water to it to be something to the advantage of everybody, and certainly to the disadvantage of no one.

9090. Then, again, I take it that water supply is a very large element of trade, say of dyeing or finishing goods?—Certainly.

9091. Originally these trades located themselves upon these rivers because they were pure?—That no doubt was the original cause of their coming.

9092. Then who suffer by the pollution of these rivers?—No doubt the inhabitants of the districts through which these waters flow.

9093. And the manufacturers?—Certainly.

9094. They come there for pure water, and find it impure?—No doubt.

9095. What relation do you imagine exists between the value of pure water and the production of marketable goods, is it a large element in manufactures to have pure water?—I suppose (in fact I know) that many trades cannot be carried on without it, scarcely any trade I should think can be carried on without pure water, it is an absolute necessity to them.

9096. What is the average price which manufacturers pay for your water?—About 6*d.* per 1,000 gallons, the price is gradually getting lower.

9097. Do they consume a large quantity at that price?—Yes.

9098. Would a manufacturer, having a large quantity of water passing his works, get it cheaper from the stream, supposing it to be clean, or from your waterworks?—Probably for some purposes he would get it cheaper from the stream, supposing it to be clean, but not for all purposes.

9099. Which do you think most economical, to make the stream impure, and then to fetch water from a distance, because you cannot have pure water from the stream, or to endeavour to keep the stream clean?—If it were possible, by any process to keep the stream clean, to obviate the necessity of obtaining pure water from other sources, no doubt the cheaper way would be to keep the stream clean, but I apprehend that it would hardly ever come to that.

9100. How much of the town of Bradford is supplied from the Manywells?—A very small portion of the town.

9101. Out of what sort of land does that water flow, is it from the millstone grit?—Yes.

9102. Is it not a particularly fine water?—I think that perhaps it is harder than some other water which

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we supply, but I believe it to be very pure, very good water.

9103. Do you think that it would be a type of the water which you generally supply?—Scarcely; in some respects it would be better, but so far as hardness is concerned probably rather worse.

9104. You have spoken of covering over the Bradford beck?—Yes.

9105. And converting it into a sewer?—Yes.

9106. That I presume might meet the evil so far as Bradford is concerned, but would it improve the river in any shape?—No; the reason why the covering over of the Bradford beck was suggested was to protect the beck from being made into a sewer, that was my object.

9107. To prevent its being an outfall from different factories?—Certainly; to prevent its being interfered with in any way whatever.

9108. But I suppose you would acknowledge the existing outfalls into the beck?—No, I should propose to take them into the new sewers.

9109. It would make no real difference I suppose in the river?—Not below Bradford.

The witness withdrew.

Mr. J. Ingham.

Mr. John Ingham (Bradford) examined.

9110. (*Chairman.*) You are a dyer?—Yes.

9111. Where are your works situated?—In the valley at the east end of the town.

9112. We went over them, did we not?—Yes.

9113. What number of hands do you now employ?—From 600 to 700.

9114. Do you know what number of dye-vats or cisterns you have upon the premises?—No.

9115. How long have your works been established at that point?—We commenced building them in 1850.

9116. Are they as large as any in the borough?—I should think not quite. Mr. Ripley's, I think, are larger.

9117. Did you carry on dyeing operations in any other part of Yorkshire before you came here?—Yes, at Halifax.

9118. Had you any special reason for removing from Halifax here?—We had more reasons than one. At Halifax we were nearly at the top of a stream called the Ovenden brook, and our neighbours below complained that we fouled their water, and they gave us the benefit of a lawsuit and also of a suit in chancery, and we had to act the same by our friends above as well.

9119. You removed away because of those lawsuits?—We came away in order to create peace and quietness in the neighbourhood. We sold the estate.

9120. Then you came away from a clean place to one which was so dirty that it could not be polluted?—Yes; that was our intention, I think, as nearly as may be.

9121. What class of goods do you dye?—Very nearly all classes of goods, from the raw material in every fibre to the finest spun yarn, and we have some piece trade which we have commenced this year. We have a large finishing establishment.

9122. Are all the goods which you dye used in England?—No; we do a great deal for export.

9123. To what part of the world?—Germany, and Russia, and to America. We also do a great deal of work for our own country. We have a great Berlin wool trade with London.

9124. Do you use much logwood, and other woods of that class?—Yes.

9125. Is it in the chip or ground?—We chiefly use chip, about 600 tons a year.

9126. What do you do with the spent chips?—Hitherto we have done the best that we could with them.

9127. Do you burn them?—No.

9128. Will not they burn?—Yes, if we put ourselves to the trouble and expense, but it would be a very expensive operation.

9129. Therefore you let them go down the river?—Yes.

9130. Do you use much indigo?—A little, some 10 or 12 chests of indigo in a year.

9131. Have you ever tried to recover the waste indigo from any of your vats?—No.

9132. Have you ever heard of its being recovered?—I have heard tell of some part of it being recovered; but for the little matter of indigo which I use it would not be worth my while to attempt to recover it.

9133. Do you use any of these new dyes?—Yes, we use a large amount of the aniline dyes.

9134. Do you use much acid with your dyes?—Yes, a great quantity.

9135. What volume of water do you use in your operations?—About 500,000 gallons a day.

9136. Do you obtain it from the town or from your own boreholes?—We obtain the chief part of it from our own boreholes, and a little from the town.

9137. What is the difference in the quality of those two waters, is one harder than the other?—Our water is 20 per cent. softer, as shown by Clark's soap test. There is carbonate of soda in it, it runs out of the millstone grit.

9138. Do you use water power or steam power?—Nothing but steam power.

9139. What extent of horse power do you use?—Our boilers are about 420-horse power.

9140. How much coal per annum do you use?—About 13,000 or 14,000 tons.

9141. Have you any idea of the weight of ashes which that quantity of coal makes?—About a quarter will be ashes. Our ashes are a very necessary thing for us, being low in the valley we have to raise the surface of the ground from six to seven feet.

9142. Have you sent any of your ashes into the river?—No.

9143. You are covering the ground with them?—Yes.

9144. Then your ashes up to this time have not been a nuisance to you?—They have not.

9145. If they were a nuisance would you at all scruple to put them into the river?—Supposing that I had the right, the same as anybody else, I should not.

9146. Do you think that it is a proper disposal of ashes to put them into the river?—A small portion of ashes does the river good, scours it out. Those ashes go down to Leeds, and there they take them out of the river bottom as sand, and sell them to us at 3*s.* 6*d.* a ton.

9147. (*Professor Way.*) Do you mean that it is economical to pitch ashes in here in order that they may be carted out at Leeds back again?—Yes, because we use them with the lime for building purposes.

9148. (*Chairman.*) Have you formed any idea as to whether your foul water could be purified?—It is so gigantic a piece of business that I dare not attempt it. I dare not look at it, I dare not take it into my serious consideration. I think that there are four or five dyeworks in the town nearly equal to mine; some of them are larger, and consequently yield to the river more filth. It will be an expensive affair to deodorize all the water so fouled, and it will also take a great space of ground. Of course subsiding tanks would be of some service, but I do not see how they would be possible in the neighbourhood of Bradford. There is no ground to spare here. I think that it would be better to carry the refuse water a long way down below Leeds to a separate tank.

9149. What would the users of water power say to that?—Of course they would object.

9150. (*Professor Way.*) You do not find any very great trouble in pumping 500,000 gallons a day?—We use a pair of engines for it. We pump 400,000 gallons a day, and we get the remainder from the town, about 100,000 gallons, or perhaps not so much as that. We feed our boilers with the town's water.

9151. If anybody told you that the quantity which you pumped was so serious a consideration that you could not look at it, what should you say?—There is

a difference in taking 400,000 gallons of clean water and bringing it to the surface, and carrying it through a large establishment, and manipulating it in the different operations of dyeing, washing, and cleansing. Dirty water is quite a different thing from clean water. It is a great deal easier at any time to do wrong than to do right. I should not attempt to make it pure water, so that you should drink it, or that I should use it in dyeing.

9152. Still, will not you admit that it is the quality of the water, when you have done with it, which is the trouble, and not the quantity?—I do not believe that it is possible to get the same results with a large quantity. You shall have any amount of money at your disposal, and any amount of utensils, and I do not believe that you could accomplish the cleansing of the large quantity of foul water which necessarily passes through a town like Bradford, in the same way as you can a small experimental matter in your laboratory.

9153. Out of the 400,000 gallons which you pump, you use a very large quantity, first for the engines, and then for the washing, is the actual quantity which runs from the dye-vats very large?—No.

9154. What quantity do you think you discharge from the dye-vats in a week, or a day?—It would be about one-third of the whole which is used for the operation. In some things it would be only a quarter, and in some things it constitutes the whole.

9155. Out of the whole 500,000 gallons of water which you use, how much would be actually used in the dye-vats, and how much for washing?—I daresay that about two-fifths of the whole would go out of the dye-vats.

9156. Irrespective of what is used for washing?—Yes.

9157. We have been told that in two or three large establishments the quantity of water used and discharged from the dye-vats is equal to 200,000 or 300,000 gallons a day. I mean from the dye-vats and not from the washing of the goods. Surely your filling and refilling of the dye-vats does not amount to 200,000 gallons a day?—We have a stream running in, and it runs out at the other end discoloured and useless, and I daresay that there is rather better than twice as much water running through the same establishment for cleaning that class of work. You must understand that we are speaking of a different class of dyeing from what you have been hitherto examining upon, unless you have examined some people in Huddersfield who are in the same trade.

9158. I can quite understand your using 500,000 gallons a day; but the question which I wish to press upon you is, whether you can apportion that water, and say how much is dye-water running from the dye-vats, and how much is waste water after the goods have been dyed?—We use two-fifths in the dyeing and three-fifths in the washing. We send down large quantities of other things which are deodorizers, so that there is not a nuisance. In our own works we use a greater quantity of acid, chloride of lime, than anywhere else in the neighbourhood. We yearly consume at least 200 tons of acids in dyeing and bleaching. We have a large bleaching establishment.

9159. You think that that acts as a deodorizer of the Bradford beck?—I thinkthat the Bradford beck is only a nuisance in colour, and that it would be less so if it was made straight from Bradford to Shipley; of course that would affect our neighbours below beneficially in the same proportion, as the water would go down more quickly to them. I believe the straightening the rivers would be the best method of cleansing them.

9160. Does the character of the water which you pump from your boreholes affect the dyeing?—Yes, it is very good dye water, generally speaking.

9161. Is it absolutely alkaline?—There is about three quarters of a cwt. of carbonate of soda, out of an evaporation for a fortnight in a 30-horse boiler. We can manage to extract that quantity of pure crystal.

9162. Then you have to use a little more acid in your dyeing operations?—Yes.

9163. (*Chairman.*) Is the reason why you do not use that water for steam purposes that it contains carbonate of soda?—No. From the town's pressure we can force the water into our boilers without pumps, and therefore we make use of the town's pressure for feeding the boilers.

9164. Do you know what it costs you in a year to pump your 400,000 gallons a day?—The pump and the well, and one thing and another, are rather expensive. I suppose that it would cost us 700*l.* a year.

9165. You do not lift that water very high above the surface?—We lift it about 28 feet above the surface.

9166. And how much from below the surface?—About 60 feet.

9167. That is less than 100 feet?—Yes.

9168. What do you pay a ton for your coals?—We are paying 10*s.* 6*d.* for the coals which we used for that engine. We keep that boiler at a little higher pressure. We shall have to pay 11*s.* 4*d.* for the coals after to-day.

9169. Do you burn more than a ton a day in lifting that water?—I should think that we do.

9170. That is too much, unless you have very bad boilers?—We have all sorts of boilers; the establishment cost upwards of 4,000*l.*, the well sinking, the pump fitting, and every other thing.

9171. That at 5 per cent. would be 200*l.* a year?—Yes, and there is the wear and tear of it.

9172. A very small per-centage would cover that?—There are the coals, and the oil, and tallow.

9173. A ton of coals a day would be enough?—A ton a day would not be enough, and the pump is a very expensive thing. I think that you will find another person at Halifax who has been pumping in the same manner, and who will tell you a different tale from what you state. I would buy my water from the town rather than bore another hole without knowing that there was water when I got down.

9174. But you have not taken out an accurate return of what it has cost?—Perhaps not, but I think that I can judge within a little.

9175. (*Professor Way.*) I want to know whether, having gone to that expense to bring water into your works, and having had the use of that water for a very valuable commodity which returns so many thousands a year, you would consider it a great hardship to be called upon to deal with that water so as to restore it to the river with the minimum amount of impurity which it was practicable to leave in it?—I believe that if you attempted to force me to clean that water, so that it should be as clean as when I got it, you would force me to shut up my establishment.

9176. As clean as when you got it is not the question which I put to you?—Or moderately clean; there would be a very great hardship in forcing me to do it, if you forced no one else to do it; but I am quite willing to assist in carrying out any scheme which could be reasonably and effectually carried out, and which would cause our friends below our works to cease complaining.

9177. Provided that any reasonable plan could be shown to you, as a large consumer of water and a large polluter of water (if I may say so), would you think it quite right, and a part of your duty to the public in general, if it lay within your power, to do something to purify that water before discharging it into the streams of the country?—Yes.

9178. (*Mr. Harrison.*) Do you dye the wool or the waste?—I dye both wool and waste; we dye all fibres, from the raw material to the cloth.

9179. Do you clean the wool as well?—Yes; we clean and scour sheep's wool, from 10,000 lbs. to 15,000 lbs. a day of sheep's wool.

9180. In pieces what weight do you dye?—About 1,000 pieces a day.

9181. About what will they average in weight?—About 7 lbs., perhaps 6 lbs.

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9182. Is that wool?—There is a large quantity of cotton. I dye from 10,000 to 12,000 lbs. of cotton a day.

9183. Do you dye any alpaca, or anything of that sort?—The pieces which I speak of include alpaca, and the wool also includes alpaca. We have a large worsted yarn trade as well.

9184. In dyeing?—Yes, from 5,000 to 6,000 lbs. a day.

9185. Will those figures added together give us the whole amount of wool and cotton?—Yes.

9186. (*Chairman.*) What number of privies have you?—10.

9187. What do you do with the refuse?—We formerly used to put it into the beck, but in consequence of a suggestion which we received from you, we have now built some privies and carry the refuse on to the land. We find that more profitable and more useful. I did not do it merely in consequence of your recommendation.

9188. You find that in that special instance you can carry on the operation without polluting the river?—Yes; the wood is another thing. I do not hesitate to say that it is necessary for the wood to be kept out of the river, at least all chip-wood, but the dissolved matters cannot be got out of the water.

9189. Then the only thing to which you do not see your way would be the purification of the liquid impregnated with the dye refuse?—Yes.

9190. Have you ever tried whether deposit of sediment would take place if you allowed the liquid to stand for any length of time?—Yes; I have no doubt that the colouring matter in the water is a floating matter (I speak of the whole of the colour which we have), and that it will very quickly fall, and that the water will become as clear as crystal.

9191. (*Mr. Harrison.*) You have tried some experiments, have you not, as to separating the colouring matter?—Yes, we do it every morning, all the dregs are left at the bottom and the water is clear.

9192. Have you tried any experiments to clear the water?—I never tried any experiments except upon small quantities; I tried to filter the water at the Halifax works, in order to take out the filth which came from the works above me, but my filter was of no use in less than four months. I had a filter 40 yards across the reservoir, but the filter was filled up in less than four months, and then it would have been necessary to take the filter out and wash it stone by stone and pebble by pebble.

9193. If you took the whole of your water from the corporation according to their schedule of prices you would have it at about 2*d.* per 1,000 gallons?—Yes.

9194. What would that cost you?—I do not know, I never reckoned it up to a nicety.

9195. It would not be a very desperate sum above what you pay now?—I say that we cannot pump it at less than 1½*d.* per 1,000 gallons.

9196. (*Chairman.*) If you had to pay 2*d.* per 1,000 gallons for it what would it amount to?—I have always considered that the price of the water, if I used it from the town would be about from 1,400*l.* to 1,800*l.* a year. I have just inquired and I am informed that we are now paying about 400*l.* a year.

9197. (*Mr. Harrison.*) But you are paying more than 2*d.* per 1,000 gallons?—Yes.

9198. (*Chairman.*) Do you use that 100,000 gallons from the town because you cannot get enough from your borehole, or is it for any special purposes?—It is just because we have not enough from our bore hole. We have some springs which give us a little water but they are not certain; for the last three or four years previous to this year we have scarcely had any benefit from them.

9199. (*Mr. Harrison.*) I think that you have one pump working inside?—Yes, we have a hollow rod, and a solid rod, and the solid rod is working inside the hollow rod; we have two lifting buckets in our pump, that is the reason of the solid and the hollow rod.

9200. (*Chairman.*) Then you do not comply with the old proverb not to have two buckets in the same well?—No; we have another little pump in the same well with a centrifugal or rotatory motion.

9201. If it could be shown to you that you could filter the waste water at a cost not greater than you are paying for pumping it when clear, do you think that it would induce you to undertake the filtering of it?—I have not room.

9202. But suppose that you had room?—That is supposing something which cannot be.

9203. You do not occupy all the land in that part of the world?—No, but they who have it I think will not allow me to have it for that purpose.

9204. What is land worth an acre just there?—I do not know. There is a man here who owns it all. They sell it by the yard. I offered him some at 5*s.*, and he offered me some at 7*s.*, and there is a fence between us, and a very few yards off that land is a guinea a yard.

9205. (*Mr. Harrison.*) Is anything done with your suds?—No, I do nothing with my suds at present. I had intended to do something with them; I wanted to have a little bit of land in the neighbourhood, but I could not get it, and I therefore thought proper to let the suds go down the river.

9206. (*Chairman.*) What weight of soap do you use per annum?—A little over 50 tons.

9207. Do you know what is about the average price per ton?—It averages from 60*s.* to 80*s.* a pack of 240 lbs.

9208. The whole 50 tons now pass clean away from you?—Yes, at present.

9209. Have you seen any of the grease extracting processes?—Yes, they are profitable processes, but they are a nuisance about an establishment. I would not have such a thing unless I was forced in consequence of my fouling my neighbours' water.

9210. Do you know how much is obtained in Yorkshire by different manufacturers for their suds?—No, a great amount of oil and grease is obtained.

9211. Would you be surprised if I told you that it was at least 100,000*l.* a year?—I should not; I have a great offer for mine.

9212. (*Professor Way.*) You, I suppose, use a great quantity of oil?—Yes, we use a great quantity of palm oil, we make it into soap ourselves.

9213. Do you not use a quantity of oil independent of that, as oil?—We use it for washing, and for things of that description; we use oil for neutralising, and for making into soap for the purpose of softening our cottons.

9214. (*Chairman.*) Should you consider it a great hardship if any law was passed which told you that you should not put any soap refuse into the refuse because you could utilize it?—Do you mean me individually.

9215. Not only you, but everybody?—Certainly not.

9216. It does not take a very large area of ground to extract the soap refuse?—It does not, but unfortunately the scouring establishment where I should say the greatest amount of soap is, is in such a position that you must pass through the greatest portion of the establishment to collect the grease.

9217. At present you are not made to adopt the process, and you do not do it?—I could do it if I had a little bit of land on the other side of the fence; the proprietor only wanted 7*s.* for that, I offered him 5*s.*, the same price as I could get for land of my own, but he would not take it.

9218. People pay as much as 18*l.* a ton for the matter extracted from the refuse, and I should think that they would get one-fourth of yours back again?—According to the best price which I have ever heard offered, the extreme only amounts to one-twelfth of the original value of the soap in that sediment water. I think that they would now give me about one-thirtieth.

9219. (*Professor Way.*) For the opportunity of recovering the valuable matter?—Perhaps they would

put down the plant themselves, but I of course should have to find the ground.

9220. (*Mr. Harrison.*) In what year did you come to Bradford from Halifax?—The property was an open field when we commenced, and we started building in 1850.

9221. Did you purchase the land upon which you built your present premises?—Yes.

9222. How much per yard was the land?—We gave 2*s.* for it then.

9223. And now you cannot purchase land adjoining, under what price?—The land is worth 3*s.* 6*d.* or 4*s.* a yard below me, but the land where I wanted to put my suds was 7*s.*; the proprietor may have raised his price now.

9224. (*Chairman.*) Do you think that land would at all increase in value if Bradford beck was made more pure than it is now?—On the hill sides I daresay it would. I believe that the hill sides would be bought up directly for villa residences; but the Bradford beck is not so great a nuisance as another nuisance which we have in the neighbourhood, which perhaps it is not your business to inquire into.

9225. (*Mr. Harrison.*) Do you mean the canal?—Yes.

9226. (*Chairman.*) You mean the canal in the town?—The canal below the town, the canal which comes up to the town of Bradford; the Shipley canal I suppose it is called.

9227. (*Professor Way.*) Is not it fed from the Bradford beck?—Yes.

9228. (*Chairman.*) Is the smell very offensive at any time in summer as it flows past your premises?—No; in dry weather in summer there is next to no water in the beck, except what we pour in ourselves; but this summer there has been plently of water coming down, and it has been very sweet.

9229. How far is the sewer outlet below your works? About 500 to 600 yards.

9230. Have you ever experienced any nuisance from it when the wind has been blowing up the valley?—No; that is sweet compared with the canal.

9231. (*Mr. Harrison.*) In a dry summer the whole of the beck is turned into the sewer, there is no water running down the beck?—There is not.

9232. Then what becomes of it?—It goes into the canal, that is to say, so much of the water as comes up to the flood gates.

9233. (*Chairman.*) Then the sewer and the canal jointly take it all?—Yes.

9234. (*Mr. Harrison.*) Is more water taken into the canal than is requisite for passing the boats below the locks?—I should think not.

9235. (*Professor Way.*) Then at that time the outfall of the sewer into the beck is actually all that is running into the beck?—Yes, except what we turn down which is very little.

9236. Otherwise the beck is a sewer?—Yes.

9237. (*Chairman.*) Are you now building any extensions to your works?—Yes.

9238. Then you will be obliged to get more land?—We have some land, but it is not in that condition that we can make a filtering bed of it. We could not have a filtering bed without raising the foul water eight feet to the surface, and after that we must lift it by mechanical power.

9239. I presume that you have not seen any process of filtration by mechanical pressure in the same way as clay waters are filtered?—I have not.

9240. There are presses in which water impregnated with clay, and in which water from paper making which is impregnated with the fibre of the paper, is filtered, and the substance is all recovered?—That is something which I did not know; the heavy dyers and papermakers near Edinburgh do not use it.

9241. (*Professor Way.*) Does the fact that they were making the water impure prove that they would not have done otherwise?—No, it does not; but I think that there is so much property involved in that neighbourhood, that it would have been to their benefit to save the fibre.

9242. (*Chairman.*) It is only the old story that when people get quarrelling they will spend three times as much over the quarrel, as would have done the work without quarrelling. They have spent about 20,000*l.* on that river in law suits?—Yes. But to compel a paper maker to carry on his business without fouling water below is to prevent his working. It is an impossibility for a man to do away with the alkaline and the ash, he must carry them into his waters. There are great bleaching powers connected with paper establishments.

9243. There are some very large persons concerned with paper making who say differently?—Perhaps so.

9244. (*Professor Way.*) Mr. Joynson is a large manufacturer of paper, he pumps the whole of the water flowing from the machine through presses, and separates all the objectionable matter, and gets about from 15 to 20 cwt. of fibre per week worth 30*l.* or 35*l.* He would not have done it unless he had been obliged by the law to do it, but at this moment he positively gets 1,000*l.* a year from that very source?—I always think that we are open to receive information. I certainly do not think that we are quite as clever as they are in London, where they have no manufacturers.

9245. (*Mr. Harrison.*) What should you consider a burdensome sum for you to have to pay annually in purifying your water, supposing that other dyers were obliged to do the same?—It is only a question of supply and demand, which rules the price of everything. If I could not pay whatever was demanded of me, I must either raise my price or give up my business. If it was a shilling more, of course I should be able to pay it if I could get it from my customers; but I could not pay it unless I could get it from them.

9246. Therefore if it can be shown that the thing can be done, and if you are put to an expense in purifying the water, then, provided all other dyers are made to do the same thing, it will be merely the question of adding a little to the cost of dyeing?—As soon as I see a practical scheme which I think is worth anybody's while to go into, I shall be as ready to adopt it as anybody else.

9247. (*Professor Way.*) If you found that the question of purification could be reduced to a question of mechanical filtration within a small space, would your views upon that point alter?—I have seen quick filters. I have now a filter on my own ground which will filter a great quantity of water in a day if you get a great pressure upon it; if I had 100 lbs. pressure I would filter my 500,000 gallons a day, but I believe that if I tried to filter that quantity of water which we turn out at the tail of our dyeworks we must give up before we had gone five minutes, we should be clogged fast. Where would you put your refuse? Where is it? It is at the top of your filter, and you must clean your filter often if you work it quickly; that is the experience which I have had.

9248. The chairman has spoken to you of filtering clays. As regards pottery water, would you be surprised to find that there is now a filter in use in nine-tenths of the potteries in England in which the clay is separated from the water at an expense of 2*s.* 6*d.* per ton of clay, including capital and all expenses. There is the fact that the solid matter can be separated from the liquid at that rate. The practice used to be to take clay and mix it with water and run it off after a certain time, during which it was let to settle?—Yes, that was the old system.

9249. And the sludge, namely, the clay and water at the bottom, was dried in kilns. They do not do that now, but they now pump this water through a machine at the rate of 2*s.* 6*d.* a ton of clay separated?—I wish that I could get 2*s.* 6*d.* a ton for refuse out of my water.

9250. The question is, how much clean water you can throw back into the stream?—In large works there are the washings of the yard, which include the grinding away of the flags with which the yard is set, and the different sands in the establishment; practically

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these would clog up your filters if nothing else did so, because you may depend upon it that they do not only frequently impede the flow of the filter water in the tanks but they shut the filters completely up, so that there would be all this refuse as well as the colouring matter.

9251. (*Chairman.*) You think that filtering is not practicable, so far as you know it?—So far as I have seen it hitherto I do not think that it is. Pressure would be a very expensive operation, and as our town's officers have told you we have quite sufficient rates already.

The witness withdrew.

Mr. S. Smith.

Mr. Samuel Smith (Bradford) examined.

9252. (*Mr. Harrison.*) You are a dyer residing in the borough of Bradford?—Yes, in the township of Horton.

9253. How many years have you been resident in the township of Horton?—For nearly 30 years.

9254. Do you remember the condition of Bradford beck when you first came to live here?—Yes; in the neighbourhood of our works it is as clear now as it was then.

9255. Are there as many works above yours as there were then?—The works have increased in number, but the water is comparatively pure still.

9256. Do you know the state of the beck below the town?—Yes.

9257. How is it now as compared with what it was formerly?—I do not know that it is much worse now than it was in those days, there were dyeing establishments on it then.

9258. Was it not the practice to send a large quantity of Bradford goods to Leeds to be dyed?—Yes, it was.

9259. Has dyeing been extended in Bradford much of late, or has it been removed from Leeds to any extent?—No dyers have come from Leeds to Bradford that I know of, no principals or heads of firms; within the space of 30 years the dyeing establishments in Bradford have increased in number by about two.

9260. Is the quantity of goods that are dyed in Bradford much in excess of what it was 30 years ago?—It has greatly increased.

9261. Do you mean that the number of dyers has been increased by only two, and that the quantity of goods dyed has been greatly increased?—Yes.

9262. In what proportion has that increase of trade taken place?—I have no memoranda to speak from on that point.

9263. Goods are still sent from Bradford to Leeds to be dyed?—Yes.

9264. How many hands do you employ in dyeing?—About 500.

9265. What are the kinds of goods that you dye?—All kinds of manufactured goods, piece goods for merchants. We do not dye any yarns, or warps, or cotton, for manufactured goods.

9266. On an average how many pieces do you dye in a day?—I will send you that information; but I may say that we reach 560,000 pieces in a year.

9267. What would be the average weight of those pieces?—They vary considerably, from 6 lbs. or 7 lbs. to 24 lbs.

9268. What is the average weight?—I cannot tell you.

9269. Can you state what quantity of water you use in your different dyeing processes?—Our daily consumption is about 800,000 gallons.

9270. Is part of that water used for your engines?—Yes.

9271. How much is used for the engines?—I cannot say, because nearly all the water that is used for the engines, after it has been condensed, is used for other purposes, so that the water that is so used does double duty.

9272. What volume of water do you use for dyeing purposes?—For making dyeing liquor it is difficult to say. I can only give you a guess; I should think that not above one sixth of what we use is used in dyeing liquor, the greater part of it is used for washing and is never heated at all, the greater quantity of it is scarcely discoloured.

9273. (*Professor Way.*) One sixth of what you use would be more than 100,000 gallons a day?—Yes; but you must recollect that in dyeing many of the vessels are only filled once a day, and some of them are not emptied for two or three weeks together, and the actual amount of the dyeing liquor which is turned down out of the place is not nearly so large as the quantity of water that is used for washing and cleansing.

9274. Did you hear Mr. Ingham give his evidence?—Yes.

9275. He stated that two-fifths of all the water he consumed was used in the dyeing processes?—Yes; but Mr. Ingham's trade is totally different from ours, he dyes warps.

9276. If I understand you aright, this (*pointing to a sketch*) is the dye-vat in which the goods are dyed?—Yes.

9277. When the liquid in that vat ceases to be of any use it would be called dye waste, would it not?—Yes.

9278. When you say that you have a sixth of the whole volume of that, do you mean that you have more than 100,000 gallons a day going in and out of those vats?—No, I do not think that we have. I know that the amount of water that goes into the vessels and which is made into dyeing liquor is not so large as that, it is very much smaller.

9279. 100,000 gallons would fill a very great number of vats?—Yes; but we have so large a number that I cannot tell you. I am sure, however, of this, that a very large proportion of the water consumed on our premises is used for washing purposes. I believe that one half of it is not even discoloured, and that in that state it passes away.

9280. Supposing dyeing water to be as black as ink, is that the nature of your 800,000 gallons, or of 100,000 gallons, or of 20,000 gallons?—I do not think that we turn out 100,000 gallons of dyeing liquor in the course of a day.

9281. (*Mr. Harrison.*) Where do you get the 800,000 gallons from?—We pump I should think about three-fourths of it out of wells of our own, and on our own premises.

9282. Of what depth are those wells?—They are sunk about 30 yards in the rock; the boreholes go down a considerable depth.

9283. Do they reach the millstone grit?—I suppose they do.

9284. To what height does the water rise below the surface?—It rises up to within about 40 feet, but it has gradually subsided; 30 years ago, when we first sunk the well, the water in our well rose within 6 feet of the surface of the ground, but it has gradually fallen down until now it does not rise within 40 feet.

9285. To what do you attribute that change?—Simply to the exhausting process of continually pumping, to that, and to other people doing the same thing.

9286. To Mr. Ingham and others pumping as well?—Yes; but Mr. Ingham's works are a mile and a half from us.

9287. Still I suppose you are pumping from the same subterranean reservoir?—Yes; we happen to have, to the west and south-west, a gradual dip of the strata coming towards us.

9288. So that you will dry Mr. Ingham's source before he will dry yours?—Yes; as far as the natural dip of the strata goes, we have the first pull.

9289. Can you state what it costs you to pump that water?—From a halfpenny to twopence per 1,000 gallons.

9290. It is a close run, is it not, between pumping and obtaining a supply from the corporation, if they can supply water at 2*d.* per 1,000 gallons?—I think that we pay them now about 600*l.* a year for water.

9291. Is there any great difference in the quality of the water that you obtain from the wells and that of the water which is supplied by the corporation?—We have an idea that we can use the corporation water better for some purposes than ours, at least we fancy so.

9292. For what purposes do you mean?—For some particular colours.

9293. Do you take advantage of the head of water as Mr. Ingham does?—No; that is rather a nuisance to us.

9294. What quantity of coal do you use in a year?—Our average delivery is about 60 tons a day.

9295. What would the ashes from that quantity of coals amount to?—About 15 loads.

9296. What do you do with those ashes?—That is a matter which has sometimes given us a great deal of trouble. We have been filling up quarries and filling up different places in our neighbourhood, and we have managed to obtain room for tipping in that way, but all our ashes and refuse and solid matter are carried away.

9297. Are your spent dyewoods carried away?—The great bulk of the dyewoods that we use are what we call rasped, that is different from chipped wood; we use only a very small portion of chipped wood and it is burned; but the rasped wood is so light, that when the clacks are drawn it runs away into the drain; it goes away floating.

9298. We have been informed that the Aire and Calder Company dredge up a good deal of that wood from the river below?—It must go somewhere.

9299. Would it be any hardship to you if you were obliged to keep that rasped wood out of the water?—I do not know how it could be done very well.

9300. Not by a simple system of filtration?—No doubt a system might be devised, but I see no means of applying it at present.

9301. Are any ashes thrown into the river in this neighbourhood?—I do not know, except that we never throw in any, nor any solid matter of any kind.

9302. Do you think it would be any hardship upon all persons who make ashes to be obliged to keep them out of the river?—None at all; it is only what ought to be done. We never put a single shovel-full of ashes into the river at our place.

9303. Have you ever taken any steps to restore the water to a state of purity after you have used it for dyeing purposes?—No; but we have been at some expense ourselves, in conjunction with some of our neighbours, in carrying our drain some considerable distance down the valley, which enables about five large concerns below us to receive the water of the brook, and use it in as pure a state as it comes to us. Our drain would have been carried still lower down, but the occupier of King's mills did not like to lose our volume of water, so it falls into the goit.

9304. Do you use water from the beck?—We use a little for condensing purposes.

9305. Do persons below you also use that water?—Yes, for condensing.

9306. How do you manage with regard to privies for the men you employ?—We have 12 privies in three sets of four each, and three water closets besides in different parts of the premises.

9307. What becomes of the refuse?—We have plenty of land, and the refuse is too valuable to be lost.

9308. Is it collected on the premises?—Yes, we have a mode of conveying it on to the land in our own occupation.

9309. Do you do so day by day?—No, it is done at stated periods.

9310. You find that it is useful to do so?—Yes.

9311. Do you collect the urine that is made by the men?—No, it is not worth while. We did try it, but it did not answer. We make all our own ammonia. Formerly we were obliged to make it from urine, but we found that so great a nuisance that we gave it up.

9312. Is the urine collected from the cottages in the villages?—Not in our neighbourhood, but on the Leeds side of the town it is all collected for the cloth millers.

9313. What do you use for cleansing chiefly?—Our processes do not require so much cleansing as woollen cloth or wool. The wool is beautifully scoured before it is combed, and it is made very clean. We use fullers earth.

9314. What quantity of fullers earth do you use in a year?—That is used to cleanse with after the dyeing process.

9315. How much of it do you use in a year?—It may be 20 tons.

9316. Do you use any soap?—Yes, we use a little in some of our preparatory processes, but not much.

9317. What quantity do you consume in a year?—I cannot tell; we make the principal part of what we use ourselves.

9318. Do you make it from oil?—Yes, and from an article that we get from Liverpool, from Price's candle works.

9319. Are there sufficient suds in the refuse from your cleansing processes to make it worth your while to recover them?—No.

9320. Should you consider it a hardship if you were called upon to cleanse the water that you use if some simple means of doing it were pointed out to you?—If a general measure was passed and some practicable means were shown we should be very glad to do what other people do.

9321. You would not object to that?—No.

9322. What area do your works cover?—About eight acres.

9323. Did you purchase that land?—Yes, I did. I bought the first of it in 1835.

9324. What was the value of the land in that neighbourhood then?—Then it was worth 4*s.* a yard.

9325. What is the land adjoining to it worth now?—About a year since I bought some land, and I gave 7*s.* 6*d.* a yard for it.

9326. (*Professor Way.*) How much water did you say you bought from the water company?—I cannot tell you exactly, but the payment we make per quarter is about 150*l.*, which is nearly 600*l.* a year.

9327. Supposing that annual payment represented 100,000 gallons, or 20,000 gallons, and you were asked to pay, instead of 600*l.*, 700*l.* a year for the water, would that prevent your using that water?—No. The fact is this, that we were early consumers of the corporation water; they charged us so much per 1,000 gallons. I represented on several occasions to the engineer the justice and fairness of giving an opportunity to the larger consumers of having water supplied to them at a lower rate, or in proportion to their extended consumption, and a new tariff was sent to us carrying the price down from 3*d.* per 1,000 gallons to 2*d.* per 1,000 upon the extended consumption. I do not know what we pay, but we have not gone to the extreme limit of 2*d.*

9328. Supposing circumstances should occur to make it necessary for the corporation of Bradford to charge you 3*d.* instead of 2*d.*, or 7*d.* instead of 6*d.* per 1,000 gallons, the effect of which would be to increase your payment from 600*l.* to 700*l.* per year, would that have the effect of destroying your trade?—No, but we should cease to consume so much, and we should help ourselves in another way.

9329. Supposing that 100*l.* or 200*l.* additional expense annually was put upon your shoulders for purifying the water after you had received it clean by a simple and easy process, so that it should be discharged again in a comparatively clean state, would that be so serious an outlay as to imperil your trade?—No; of course I am supposing that other people engaged in the same trade would have to do the same thing.

9330. Would such an additional annual expense

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frighten you?—No; we should not be frightened by a trifle of that sort.

9331. (*Mr. Harrison.*) You say that your neighbours use the water of the beck for engine purposes?—Yes.

9332. Lower down the town can they use the water of the beck for those purposes?—Yes, all the way down. There are five large concerns immediately below ours, which have an advantage from the fact that our drain passes through their premises. Afterwards the water is carried through into the goit, and still people draw from it.

9333. Take the manufacturers who are situated on the lower part of the Bradford beck, can they use the Bradford beck water for engine purposes now?—Yes. Even our dirty water has its advantages, and I will tell you what those advantages are. It is not clean enough for condensing purposes, but for supplying boilers the water which goes from our works and from other works below is in such a state that it does not cause incrustation in the boilers. It is therefore safer for that use in boilers than pure water.

9334. If used for engines, does it not cause them to prime very much?—No. The chief thing for condensing purposes is that it shall be cold. I remember some years ago in a dry summer that the whole of the mills on the stream below our works were dependent upon the water which they pumped up after we had used it; so that if we had stopped they would have stopped. There was no water coming down the natural stream at all, and all the mills were dependent upon the water that we raised from our wells.

9335. What had become of the water in the stream?—I do not know. It was in a particularly dry time.

9336. Now if you were to cut off the water company's supply in a dry season, such as we had a year or two ago, there would be hardly any coming down the beck?—There would be none at all.

9337. (*Professor Way.*) Then I suppose you think that any scheme that proposed to divert the water from all the mills into a great sewer and take it down some distance would be productive of serious injury in taking the water away?—Yes. The fact is that we have at present for our own concern a method under our consideration by which we think we can take all our water from our place into a drain, and never pass it into the watercourse at all. It is within reach of a drain that is already in existence.

9338. That would seriously interfere with the quantity of the water, would it not?—Yes.

9339. (*Mr. Harrison.*) And it would also interfere with the water power below you?—Yes.

9340. (*Professor Way.*) Therefore, if it were practicable, the reasonable thing would be to return the water as pure as you could into the stream direct from each mill?—I have often thought that with a little arrangement if we could sort our water after we had used it, especially keeping to itself the water that is used for washing purposes, we might send down a considerable stream that would go far towards supplying the canal with water entirely without any smell, and almost without any colour.

9341. (*Mr. Harrison.*) You mean if you separated the dye water and let it go down the sewer?—Yes. If the Commissioners had time to come to our premises for a short time before they left I should be very glad to explain to them how I think this could be done. They would then see how the water is used and what water is passed. In a concern like ours we use a large quantity of acids and metallic solutions in various forms, and after these have been exhausted the waste waters are all passed away, some of them carrying a great deal of very strong matter with them not offensive to the smell, but it would be injurious to vegetation.

9342. (*Chairman.*) And would perhaps prevent cattle drinking from the stream?—Just so.

9343. Have you tried irrigation in any form and watched its effect?—No, I have not.

9344. What quantity of acid do you use in a year?—That is a difficult question to answer.

9345. Do you use a large quantity of acid?—Yes, a great deal.

9346. And iron liquor?—Yes; we make a great deal of solution of iron ourselves.

9347. (*Mr. Harrison.*) Is it difficult to give the quantities of acid, iron liquor, dyewoods, and different things that you use per annum?—It would be perfectly easy for me to do that in my counting-house. We can give you the quantity of the woods that are cut and used in the course of a year. The only concern that I know of that ever made any attempt to purify the water was a concern near Halifax where I was engaged when a boy. They ran their drains into a sort of reservoir or filtering dam below the works. It was upon a hill side and there was plenty of fall, and the water was in this way very much divested of its peculiar character, both as regards colour and purity.

9348. Mere mechanical filtration and rest did something to purify it?—Yes.

9349. All the dye refuse which you send into the river and the colouring of the river ceases to be observable at no very great distance below you, if it is not renewed again by other dye works?—Perhaps so, but I have never noticed that.

The witness withdrew.

Adjourned to to-morrow at 10 o'clock.

Bradford, Wednesday, 14th November 1866.

PRESENT:

ROBERT RAWLINSON, ESQ., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, ESQ. | Professor JOHN THOMAS WAY.

Mr. D. Swallow.
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Mr. DAVID SWALLOW examined.

9350. (*Chairman.*) Are you manager of the Bradford gasworks?—Yes.

9351. Is it a company?—Yes.

9352. Where are the works situated?—In Mill Street adjoining the Bradford beck, and also in Thornton Road, in both cases close to the beck course.

9353. How long have those works been established?—Since 1823 or 44 years ago.

9354. What number of retorts have you in use now?—At the present time there are about 430 or 440.

9355. What cubic volume of gas do you make in a year?—370,000,000 cubic feet.

9356. What tonnage of coal do you use?—40,000 tons per annum.

9357. What kind of coals are they?—They are half Yorkshire, Cannel, and other coal; in fact the best coals we can get.

9358. What amount of coke do you get in that quantity of coal?—About 12 cwt. per ton.

9359. How much of that coke do you use on your own works?—About two-fifths.

9360. Is the other part of it distributed in the district?—Yes; it is sent away, some of it a considerable distance.

9361. Do you use lime for purifying the gas?—Yes.

9362. What amount of lime do you use per annum?—We use about 19 cwt. or one ton in a caustic state, or about 3 tons 8 cwt. in a hydrate form.

9363. Does it increase in weight by use or not?—Sometimes it does, but that depends upon the state of the condensation.

9364. What do you do with the spent lime?—We have hitherto given it away to any of the farmers who would fetch it.

9365. If they do not fetch it, does it accumulate upon your premises?—Yes, at certain seasons of the year; at the present time we have rather a considerable quantity.

9366. How many tons do you think?—I think we have about 350 tons at present on the premises.

9367. Have you used oxyde of iron to purify the gas with?—We did a few years ago, but we did not continue it.

9368. Was it too expensive?—No, it was rather in our favour in a pecuniary point of view, but it did not answer so well.

9369. Did it not purify the gas effectually?—It did not.

9370. Have you heard any complaints made by your neighbours as to the accumulation of spent lime upon your premises?—Not generally; sometimes parties have complained a little.

9371. Do any of the inhabitants living about the works bring their children into your purifying house when they are suffering from croup or whooping cough?—Yes, they do frequently come.

9372. Are they always allowed to enter?—Yes.

9373. Do any of the medical men ever order the children to be taken to the purifying house?—Yes; I know that one physician in Bradford has done so.

9374. Do you think it has a beneficial effect?—I really cannot speak to that, but I should say that good mountain air would have more effect.

9375. What number of men do you employ on your premises?—About 250, including the pipe layers.

9376. What sort of health do those men enjoy?—They have very good health, and particularly those who are employed in the purifyers.

9377. Do you think that there is anything injurious in the manufacture of gas?—I think not at all.

9378. How long have you been manager of the works?—For 25 years.

9379. Have you ever suffered in health?—Not at all.

9380. Can you smell it now offensively?—Yes.

9381. Sometimes it is offensive to you?—Yes; I smelt it last night in consequence of an accident which occurred; one of the valves was left open, and the result was that a lot of impure gas got into the mains.

9382. Is any refuse passed from your works into the river now?—None whatever.

9383. Do you find a ready sale for all the products from your gas works?—Yes, but sometimes the coke accumulates to a considerable extent.

9384. What do you get a gallon for the tar?—We do not sell it by the gallon, but by the ton, and we get 1*l.* a ton for it.

9385. Is that price higher or lower than it used to be?—Higher. We never had more than 12*s.* a ton for it till last year; it is sold by contract, and it goes down to Mr. Hewlay, near Leeds.

9386. What do you get for the ammoniacal liquor?—We receive a fixed sum per annum for all we make.

9387. And do the buyers clear it from the premises?—Yes.

9388. What is that fixed sum?—It is 880*l.*, and that will also include any increase that we may have for a number of years to come.

9389. Did you ever try to make mortar with your spent lime?—Yes, and found that it would not answer as mortar; it crumbles away, and there does not appear to be the consistency of lime about it.

9390. Have you tried it?—Frequently.

9391. What then is it used for?—For agricultural purposes.

9392. And you are willing to give it away to any extent if the parties will come and cart it away?—Yes; we do so.

9393. What do you get for the coke?—It varies according to the quantity we can sell to one individual, from 5*s.* to 8*s.* a ton.

9394. What does the coal cost you?—That also varies in price—from 8*s.* 9*d.* for common coal, up to 10. 6*d.*; and from 10*s.* 6*d.* for canal coal, up to 18*s* 4*d.*

9395. How frequently have you occasion to change the water in your gas vats where the gasometers stand?—I think we have not had more than four changes since the commencement of the works.

9396. And I suppose those changes have occurred when you have wished to make repairs?—Yes.

9397. You could go on almost constantly with the same water by supplying that which evaporates?—Yes, but we do not keep the same water in the tank; we pump fresh water in every day. We have a pipe laid into the retort house to slake the coke, or for any purpose that we might require it for; if we emptied the tanks within a foot of the bottom, the effect might be bad; but for a few inches from the surface it would not be at all injurious to let it flow down the beck.

9398. (*Professor Way.*) Have you good reason for thinking that iron would not answer your purpose for purifying?—Yes, I am aware that it is used largely, but I believe that they would not use it in London if it were not for the nuisance of the lime. It is not found to answer the purpose better.

9399. You do not think it purifies the gas better?—No, nor so well.

9400. Are you aware that it is being introduced throughout the country very largely?—Yes; it freed London of a great nuisance in the refuse lime, and that was why it was adopted there.

9401. If it was so in London, would it not be so in Bradford?—To a certain extent it is so, but what is considered a nuisance to some parties is not considered a nuisance to others. Some people rather like the smell of the gasworks.

9402. Supposing the collection of the lime refuse to become very great, and to be complained of, I suppose you would readily adopt the iron process?—Yes.

9403. If you keep the water in the gasholders for any length of time, would the gas be liable to take up from that water injurious smells in addition to its own smell?—In winter time there is a certain condensation that takes place in gasholders. In summer time when there is a great heat upon gasholders all this is changed; but it is chiefly the essential oil; it improves the quality of the gas, and I do not know of anything that is injurious.

9404. Is there any naphthaline?—We never find much of that.

9405. Have you any particular object in replacing the water day by day?—No, but we consider it to be a most injurious plan not to keep the tanks clear, and free from any smell; there is always a little smell where water is left in tanks without being changed.

9406. Is the rusting of the tanks themselves obviated to some extent by that change of water?—We have not got cast iron tanks; they are made of bricks, lined with Roman cement. The gasholders themselves we keep tarred over to preserve them.

9407. Does the use of fresh water tend to remove the ammonia which the gas might contain?—It will have a certain effect no doubt; if there is any ammonia it will seize it to a certain extent.

9408. And the use of fresh water would purify the gas rather than otherwise?—Yes, it would.

9409. (*Chairman.*) What is your price per 1000 cubic feet for gas now?—3*s.*, subject to a discount of 20 per cent. to the highest consumer on a graduated scale.

9410. Do you remember what it was when the works were first established?—12*s.* 6*d.*, instead of as now, 3*s.* per 1,000 cubic feet.

9411. What is the capital account of the company?—About 150,000*l.*

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9412. What per centage do they pay?—10 per cent., but not upon that amount.

9413. Have you any spare land in the neighbourhood of the works for extensions?—Yes.

9414. Are you likely to extend the works?—Yes.

9415. Is there more than one company supplying Bradford with gas?—No.

9416. Have you land sufficient to enable you to keep up with the requirements that may arise?—Yes, we have sufficient to erect works upon of about double the size of the present works.

9417. To what extent is your longest main carried out from the works?—About three miles.

9418. Do you go beyond the borough with your supply?—No.

9419. What is the diameter of the largest main?—18 inches.

9420. What is the diameter of the smallest main?—Two inches.

9421. Is that made of cast or wrought iron?—Cast iron.

9422. What are the pipes made of for house services?—Of wrought iron in all cases.

9423. What length of lift will the wrought iron service pipe have?—It varies, according to the nature of the soil.

9424. What is the best kind of soil for the pipes?—We find there is nothing better than good earth or sand.

9425. What is the worst kind of soil?—Where the coal strata set in. We had a line of pipes in a street above the parish church, and we had to take them up. I could cut through the metal just as if it were plumbago, it was so soft, but that was from the coal strata which came out there on the surface of the earth, and the sulphur arising therefrom.

9426. A sort of chalybeate water?—No, it was free sulphur that was given out in the strata of the earth.

9427. Do you use any means to protect the iron if you find the strata are so injurious?—Yes; when we come to clear the ground we take out what may be considered injurious and put in earth.

9428. Do you prepare your pipes by putting on a coating of varnish?—Yes, we do, the service pipes, but not the mains.

9429. For what length of time will cast iron mains last in the best part of the town?—We have taken them up after they have been down 25 years, and they have been as good as the first day they were laid down; in certain situations they are very much more deteriorated.

9430. What joints do you use?—Leaden joints.

9431. Have you ever tried turned and bored joints?—Yes.

9432. Do not they answer?—I do not like them so well.

9433. Of what depth is the socket?—About from 4 inches to 4½.

9434. Do you ever find them draw in consequence of the contraction which takes place or of the weight of the pipes on the hill sides?—Sometimes we find that a few joints are leaky.

9435. Have you ever found them drawn completely out?—Never.

9436. Is there any strain by pressure upon the joints?—No.

9437. What per centage do you allow for condensation in your mains?—I do not know; that is rather a difficult thing to say. I have never been able to account for it. In some instances where pipes have become disarranged in consequence of sewerage works going on, the joints have been shaken, and water has got in, and we have not been able to discover the amount of the condensation.

9438. But there is a certain amount of condensation that always takes place?—Yes, but not so much as is generally supposed, I think.

9439. Do you pump atmospheric air into the gas holders to any extent?—No.

9440. Is it customary with any managers of gas works to force in a little atmospheric air?—I believe it is; where they use oxyde of iron, they put 1 or 2 per cent. of atmospheric air in.

9441. Have any explosions taken place at your works?—No.

9442. Could you explode one of your gasometers?—Yes.

9443. Would you not set it on fire?—Yes, you can explode a gasometer only when it has been newly commenced, and has a certain quantity of atmospheric air in; not when it is full of gas; it could not be then exploded.

9444. You could not blow a full gasometer up, but you might set it on fire?—Yes.

9445. (*Professor Way.*) Is it not possible, if the weights of the gasometer are not properly regulated that air should be mixed with the gas?—No.

9446. I mean by making the gasholder too light?—No, it would not work if that was the case.

9447. In some cases do they not pump the gas out of the gas retorts?—No; it is exhausted to take off the pressure, but we never allow less than a certain pressure at the entrance into the exhauster.

9448. But that is not always done, is it?—Not in all small works where exhausters are not used; but it is chiefly in the large ones.

9449. Is it possible to draw air through the luting of the doors?—Yes, very possible.

9450. (*Chairman.*) Do you use iron or earthenware retorts?—Earthenware.

9451. How long have you done that?—For the last 20 years.

9452. What is the proportionate duration of an earthenware retort as compared with an iron one?—That depends entirely upon the usage it receives and the time. An iron retort might be burnt in one night by the carlessness of the men, but a clay retort could not; they might get a clay retort to an intense heat, but it would be in good condition.

9453. Do you use steam power for any purpose?—Yes.

9454. Have you ever tried so to place a steam boiler that you could turn the waste heat from any flue, and so get the steam up without an independent fire?—No; our works are not so arranged as to admit of that very easily.

9455. Suppose you were engaged in works that required steam power, has it never occurred to you that the spent heat from firing the retorts could be passed through a system of boilers, and so give you a very large amount of horse-power without any cost?—Yes, we did it a few years ago, but we had alterations to make and we dispensed with it; it can be done.

9456. Supposing that you had attached to your works a large pumping establishment for waterworks, could you not use the spare heat from your gas-making operations and so pump all the water?—Yes, we could.

9457. Is there not in your works a vast amount of heat which is wasted?—Yes.

9458. Which passes up the chimney uselessly?—Yes; in the evening you may see it blazing out of the chimney.

9459. What is the diameter of the flue at the base?—I cannot speak to that.

9460. Is it 10 or 20 feet?—Not so much.

9461. What height is it?—About 40 yards.

9462. Is it cracked?—Yes, it was cracked; we have been hooping our chimneys this year; every chimney that we have is now hooped.

The witness withdrew.

Mr. Henry Mitchell (Bradford) examined.

Mr. H. Mitchell.

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9463. (*Chairman.*) Are you a merchant in Bradford?—Yes.

9464. Where are your works situated?—In Leeds Road.

9465. What are they?—I am a stuff merchant.

9466. What number of hands do you employ?—About 150.

9467. Do you use steam power?—Yes.

9468. What becomes of the ashes from your works?—They are carried away. I have not noticed what becomes of them, but we have very few.

9469. Do you use water at your works?—Yes.

9470. Where do you obtain it from?—From the town.

9471. From the corporation?—Yes.

9472. Where does the waste water go?—Into a drain; it does not go directly into the beck, there is a culvert under the warehouse.

9473. At all events it goes I suppose the way of all the Bradford water?—I believe so.

9474. What sort of accommodation have you on your premises for the workmen; are there water-closets or privies?—Waterclosets.

9475. And they drain also I suppose into the sewers?—Yes.

9476. You reside I understand at Esholt Hall?—Yes.

9477. How far is that from Bradford?—Five miles.

9478. Is that situated on the banks of the river Aire?—It is very near the river; it is about 100 yards from it.

9479. What distance does that river flow through the estate to which the hall belongs?—I believe for about five miles.

9480. How long have you known the river?—All my life. I was born in that village.

9481. In what condition was the stream when you first knew it?—It was very clear water.

9482. In what condition is it now?—It is very filthy and very bad.

9483. What does the filth arise from;—I think it arises chiefly from the Bradford Beck, also from several mills and factories on the river and partly from Shipley.

9484. That is from the works which are situated on the Bradford Beck, within the borough and without?—Yes.

9485. And also from works situated on other becks and streams, and upon the main river itself above?—Yes.

9486. What is the color of the water as it flows past your premises?—It is almost black sometimes, always very dark.

9487. What is its character in a very hot summer?—I believe it is very offensive; but we have not had much hot weather since I have been there. I have only been there seven months.

9488. What mills are there on the river?—There is a woollen mill in the village of Esholt, also Buck Mill, about a mile and a half further up; and there are two or three mills at Shipley, and at Saltaire; above that again there are some; and there are several others in the neighbourhood of Bingley, and I think there are some in the neighbourhood of Keighley.

9489. Do you think it is the pollution which proceeds from those mills that injures the river?—Yes. It arises more or less from the mills, but chiefly from the Bradford beck.

9490. Whatever amount of pollution there is in the beck, I suppose you contribute a little towards it?—We have no mill.

9491. But you said that you had some works that drain into the beck, did you not?—We have a warehouse, but no manufactory.

9492. The sewage from your warehouse goes down into the beck, does it not?—I presume that nearly all the Bradford sewage goes in.

9493. Has it occurred to you what should be done to obviate this difficulty as to pollution?—No; it is not a subject that I have given much attention to.

9494. Is it possible, do you think, for the water of the river to be purified by dealing with Bradford alone?—I think it might be greatly improved by dealing with Bradford alone.

9495. Do you think if Bradford were dealt with alone that you would see such a visible alteration in the condition of the river that you would have no cause of complaint?—Yes, I think so.

9496. You stated that there were other works that pollute the river besides those which are situated on Bradford Beck?—Yes; but only to a very small extent.

9497. There is the Guiseley and the Yeadon Beck?—Yes; Yeadon Beck is very bad; it flows through pleasure grounds into the river. The Guiseley Beck is not so bad, as it has been considerably improved by means of soap ponds.

9498. Is not the question so large and wide that it requires something to be done beyond dealing with the Bradford Beck?—Yes, I think it is a national question, and that it requires general attention.

9499. (*Mr. Harrison.*) Are there not several towns, such as Keighley and Saltaire, rising up, and Bingley and Shipley, and do not they pollute the river to a considerable extent?—Yes, more or less.

9500. Are not those places increasing in importance?—Yes, they are all increasing, especially Shipley.

9501. Does not that circumstance appear to point out the necessity for not confining any improvement to Bradford alone?—Certainly.

9502. (*Professor Way.*) The question was, whether the district generally should be dealt with, or whether Bradford should be dealt with alone?—I understood the question to be, if Bradford was dealt with alone should I have much complaint, whether it would not so visibly improve the state of the river that it would be considerably better.

9503. Still you believe that any measure should be general throughout the district?—Certainly I do. The chief source of pollution now is no doubt from Bradford, and in a few years other places will contribute very largely to pollute the river also.

9504. If Bradford was made to take any steps to purify the river, you think that other towns should be put in the same category?—Certainly.

The witness withdrew.

Mr. John Holmes (Bradford) examined.

Mr. J. Holmes

9505. (*Chairman.*) You are gamekeeper, I believe, to Mr. Stansfield?—Yes.

9506. At Esholt Hall?—Yes.

9507. How long have you been there?—For 28 years.

9508. In what condition was the river when you first knew it?—It was very clear, as clear and as bright as possible.

9509. Were there any fish in it?—It was full of fish of all kinds.

9510. What extent of river frontage is there to the estate?—It is close upon five miles from the beginning to the end of Mr. Stansfield's estate.

9511. Does he own both sides of the river?—Yes.

9512. Are there any mills belonging to him on that part of the property?—Yes; there are two mills.

9513. What are they?—They are cloth mills.

9514. Was there ever any salmon fishing on that river since you remember it?—No; I have never heard of salmon being in it.

9515. Have the Salmon Fishery Commissioners visited the river lately?—Not that I know of.

9516. What kind of fish did you find in the stream when you first knew it?—There were trout, and dace, and perch, and chub, and roach, and gudgeons, and eels, and pikes.

BRADFORD.

Mr. J. Holmes.

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9517. Are there any fish of any kind in it now?—If I was to say that there was not one I should be wrong, but they are very odd ones; there is nothing but a few chub.

9518. In what condition was the river last summer; was it a dry summer?—Yes; it was very dry.

9519. Was the water low?—It was very bad indeed.

9520. Is it the water that is so bad or the mud banks, or which are the worst?—The water. It came down last summer, a year since this, and the few fish that there were it killed them all right down as far as the Stansfield estate went, eels and everything.

9521. Have the cattle the means of getting down to the river to drink?—They can get to it.

9522. Do you ever see them drink the water now?—I have never seen them drink it for these two or three years.

9523. Used they to drink it?—Yes; 20 years ago I have seen them drink it; they used to drink it then.

9524. If the cattle were to go into the river now in summer, would the water discolor them?—I cannot say; it would discolor them as far as the depth they went in, about their feet and hocks; they would come out colored.

9525. Would they come out blue?—Yes, and black, a little shade would not color them.

9526. Were there any wild fowl on the river when you first knew it?—Yes.

9527. Are there any on it now?—Yes, a good many.

9528. What other rivers and streams are there that are colored as well as the Aire?—I do not know that there are any except a brook or two.

9529. The Yeadon beck, for instance?—Yes; that is very bad; that comes into the Aire; it comes in close by the hall.

9530. What makes it bad?—It is the manufacturing up in Yeadon—the gas works and mill—Guiseley is not so bad as it used to be.

9531. Do you know what has made it better than it was?—Yes; filtering the water at the mills.

9532. Where do they filter it?—Close by the mills, they run it out from one pond into another.

9533. You mean into pipes?—Yes, and they can let it out and clean the pond out.

9534. By that means the water is not so much polluted as it used to be?—No.

9535. They empty the ponds occasionally?—Yes. I believe that trout can live in the Guiseley brook near the hall.

9536. (*Mr. Harrison.*) Have you remarked any difference in the level of the bed of the river since you have known it; has it risen at all?—No, I do not think it has.

9537. Is the land more subject to flooding than it used to be formerly?—I do not know that it is; not that I can say. I do not see much difference in the flooding of the land.

9538. Do the floods come down as they used to do formerly?—Yes.

9539. Is there as much game now as there was when you first knew the estate?—No, not as when I first knew it. I got it up to a good pitch, but now it is thinner.

9540. Is it thinner because you choose to keep it so, or what is the cause?—A railway came, the Leeds and Bradford railway and the Otley line, and there were a good many navvies about, and much game could not live where those men were.

9541. Are there many rabbits on the estate?—Middling; we had more in Mr. Stansfield's time. I have killed as many as 900 and 1,000 in a season, but I shall not kill that number this season.

9542. What number of hares are killed on the estate in a season?—I do not think we shall kill above 20 where the navvies have been.

9543. Of how many acres does the estate consist?—I really do not know exactly.

9544. Is the whole of the shooting retained, or is any of it let out?—No, not in the Esholt estate; it is all let to Mr. Mitchell.

9545. Have any of the farmers liberty to kill or shoot rabbits?—No, not if we know it.

9546. (*Professor Way.*) You say that all the fish are destroyed, even the eels?—Yes, I believe so.

9547. It takes a good deal of filth to destroy them?—I thought it did.

9548. They are very hardy fish?—Yes; they will live nearly anywhere.

9549. But not in this stream?—They could not live in it last summer; they might live in it now.

9550. Did you ever fall into the river at any time?—I have been in it. I have bathed in it before now.

9551. But not since it was so filthy?—No.

9552. Did you ever taste the water within the last year or two?—I once slipped into the river off the stepping-stones, and I got some of the water into my mouth, but I spluttered it out again.

9553. Did you observe whether it was acid or not?—No. I should not like to taste it—to swallow it.

9554. Do gudgeons live in clear water or dirty water?—They like clear, pure water.

9555. They will not live in dirty water?—No. When I first came here I used to supply Mr. Stansfield with fish out of the river. For eight or ten years he never sent to Leeds for any fish. He had eels and trout and fresh fish regularly every day.

9556. (*Chairman.*) Were there any otters upon the estate?—There have been one or two since I came.

9557. Are there any now?—No.

9558. Are there any in the upper parts of the valley, where the water is purer?—Yes, up above Bingley I believe there are.

9559. What do they principally feed on, trout or salmon?—They will feed upon any kind of fish that they can catch. They will feed upon scaly fish; they will take the fish out on to a large stone and leave the scales.

The witness withdrew.

Mr. JOHN RILEY (Bradford) examined.

Mr. J. Riley.

9560. (*Chairman.*) You are gardener at Esholt Hall?—Yes.

9561. How many years have you been there?—About six years.

9562. How near are the gardens to the side of the river?—The kitchen garden is about 130 yards from the river side, and the pleasure grounds abut up to the river side.

9563. Do some of the ornamental walks run parallel with the river?—Yes.

9564. Is there a footpath or road which is parallel to the river and runs through the estate?—There is not.

9565. A public road, I mean?—There used to be one, but that is now done away with, and it runs about a quarter of a mile away now, but there are walks all over the estate—pleasure walks—and there is one that runs by the river side to the church at Esholt.

9566. Is it a public walk?—No, a private one; it is about half a mile or three quarters in length.

9567. What extent of garden ground have you under your charge?—Altogether there are about eight acres, or between seven and eight; that is, the pleasure ground and kitchen gardens.

9568. What state was the river in when you first knew it?—It was rather in a dirty state, but it was not so offensive then as it was in 1864 and 1865. In 1861, 1862, and 1863 it was slightly offensive at times during the summer time; but the rainfalls in the summer time came pretty regularly, and the filthy matter got away better.

9569. Have you ever seen any dead carcases floating on the water in the summer time?—Yes, repeatedly, especially in 1864 and 1865.

9570. What becomes of them, or do you remove them?—We cannot remove them; they pass on.

9571. Have you large vineries on the premises?—Yes, very large.

9572. Is not carrion good for the roots of vines?—I do not believe so very much in that. I think that some good manure, horse droppings or crushed bones are much better. The vines grow too rapidly with carrion at the first, and then the soil becomes too heavy and the roots rot off. What you want is to have a porous soil, very good and moderately rich.

9573. You would not use dead dogs for vine cultivation?—Certainly not.

9574. How near does any part of the hall stand to the river?—The hall is about 60 yards from the river or a little over that—between 60 and 70.

9575. Have you known any inconvenience to be experienced there by foul smells from the river?—I have known this; in 1864 and 1865, at intervals, the river was in such a filthy state that they could not have the windows open. Mrs. Fairbairn could not bear her bedroom window open for several days.

9576. If the stench was so bad as to reach to the hall, what effect would it have upon persons walking upon the margin of the river?—They could not do it with any comfort; they must have their pocket handkerchiefs to their mouths or their fingers on their nostrils.

9577. As to comfort and enjoyment, the pleasure grounds are seriously injured?—Yes, they are very seriously injured indeed.

9578. From what becks does the greatest amount of pollution come?—I should say the Bradford beck.

9579. From any other?—There is the Yeadon beck which stands next. It is a very dirty stream now, as the whole of the sewage from Yeadon and from some mills and dye works and gas works come in, and all the mills dye nearly, and therefore dyeing matters are cast into the beck. It comes down through the Esholt Hall grounds and runs into the river near the hall.

9580. Did you ever try any of the water for irrigating the plants?—We have the Guiseley beck water, but that runs through a filtering house and then into a large pond or reservoir, from which sometimes we take water for watering in the gardens.

9581. Does that answer?—It does pretty well; I have not seen any injurious effects from it. I cannot say that any of these streams have been so bad lately. The chief water that we get comes from a spring called the Nunwood Spring, that water is brought by iron pipes.

9582. Do you use that for irrigation?—Not for irrigation, but for general purposes.

9583. Do you use it for the grape houses?—No, not for the grape houses; we use the water that comes down from Guiseley Beck for them.

9584. Is the dwelling-house supplied with water?—Yes, it is well supplied with water.

9585. Where does it come from?—It comes from a field called Hopwood field, about 300 yards away from the Hall; it is the best water, and is brought down to Esholt Hall in leaden pipes.

9586. Is it delivered into cisterns on the top of the house?—No, that is delivered to all the places in the lower apartments, such as the kitchen, the scullery, the servants' hall, and the pantry.

9587. How are the waterclosets in the upper part of the house supplied, and the bedrooms?—Water from a spring called Nunwood spring, supplies the waterclosets.

9588. What become of the rain water?—That I think passes away.

9589. You do not use it in the gardens?—No.

9590. Are you ever short of water for the gardens?—Never; we have always plenty.

9591. Sometimes more than you want perhaps?—Yes; for instance, this year we have had more than we wanted. I can tell you what the rainfall has been. Up to the end of October with us it has been 33 inches and 33-100ths from the 1st January.

9592. Have you kept a rain gauge for any length of time?—Yes; and I have got the rainfalls put down on this paper which I will hand in (*handing in the same, which will be found printed at the foot of the evidence of the witness*).

9593. (*Professor Way.*) What is the rainfall on the average in this district?—I think it is something like 28 inches.

9594. (*Chairman.*) Can you recollect which was the dryest year?—Since I have been at Esholt Hall the dryest year was 1864.

9595. How much was the rainfall then?—I think it was 23 inches.

9596. Which was the wettest year that you can recollect?—This has been the wettest year.

9597. Has it occurred to you that anything should be done to put the river in a better state?—I have thought of that many times, and the only thing that I can see is for some gigantic scheme to be carried out, that is, to make some large ponds or settling places to catch all those dirty matters that come down from Bradford Beck.

9598. And treat it in the same way as the Guiseley water has been treated?—Yes, to have a sufficient settling pond made, and when it gets full run it off, and let it be cleaned out when it is dry. That seems to me the most likely thing that can be done.

9599. (*Mr. Harrison.*) Do you know where that part of the river is (*handing a photograph to the witness*)?—Yes.

9600. Have you known it for many years?—Yes, for six years.

9601. Are the stones there that you see in the photograph as they were when you first knew them?—Yes, and they have been there for centuries.

9602. Is the river at all filled up about the stones?—Not much?—There are at times floods which wash out the bed of the river and carry it away down to the sea.

9603. But they do not remove the stones?—Yes; at times a flood washed them away, but then we carry them back again to their places.

9604. Is there much of a village at Esholt?—There is only a very small village.

9605. How many inhabitants are there in it?—I really do not know, but I think perhaps about 400.

9606. Where do they get their water from?—There are several springs which run down the village.

9607. Are they well supplied with water?—Yes.

9608. (*Professor Way.*) You say that you think the best method of dealing with the beck would be to have settling ponds for the black mud?—Yes.

9609. Would it not be better not to have any black mud in the beck at all?—That would be the best thing, if it could be done.

9610. The chairman asked you about using the water of the beck for watering the plants. I suppose that water might be very offensive to the smell and very injurious to health, and yet not injurious to vegetation?—Quite so.

9611. So that the fact that it does not injure the plants does not prove that it is not in a very objectionable state?—No.

9612. (*Chairman.*) Is there a farmyard on the premises at Esholt Hall?—Yes.

9613. What becomes of the drainings from the farmyard?—They are gathered into a tank, and then they are pumped out and taken either on to the grass land, or else thrown on to manure heaps.

9614. Where does the drainage from the waterclosets go?—Into the river.

9615. If the river is to be purified, you will have to keep the contents of the waterclosets out of it?—I suppose that would be so.

9616. Do you think that if the watercloset refuse were put into a tank like the manure from the farm yard, you could do any good with it in your garden?—Yes, there is no doubt of it.

The witness withdrew.

BRADFORD.

Mr. J. Riley.

14 Nov. 1866.

RAINFALL at ESHOLT HALL, near BRADFORD.

	1861.	1862.
January	1·92	1·68
February	4·29	0·65
March	4·18	4·30
April	1·23	1·70
May	0·59	4·10
June	1·37	2·20
July	3·35	2·34
August	1·16	2·29
September	3·22	2·19
October	1·07	5·24
November	3·49	0·82
December	2·09	2·14
	27·96	29·65

	1863.	1864.
January	6·23	1·34
February	0·69	1·68
March	1·03	2·78
April	0·80	1·77
May	1·17	2·21
June	3·13	1·41
July	1·28	0·65
August	4·32	0·86
September	4·00	2·00
October	4·53	3·60
November	2·34	3·43
December	2·18	2·13
	31·70	23·86

	1865.	1866.
January	2·33	3·73
February	1·98	4·38
March	1·08	2·52
April	1·04	1·56
May	2·07	0·87
June	0·77	3·59
July	1·98	5·10
August	4·33	4·23½
September	0·13	5·41
October	6·17	1·99
November	3·25	
December	1·78	
	26·91	33·38

Total of Rainfall for the Years—

	Inches.
1861	27·96
1862	29·65
1863	31·70
1864	23·86
1865	26·91
1866, up to the end of October	33·38

Every inch of rainfall on the land is equivalent to 100 tons of water per acre.—*Mr. Denton, G. Chronicle, March* 28.

T. Constable, Esq.

THOMAS CONSTABLE, Esq. (Otley), examined.

9617. (*Chairman.*) You are a solicitor?—Yes.

9618. Where do you reside?—At Otley.

9619. What length of time have you resided there?—I have been professional adviser and personal friend of Mr. Stansfield, of Esholt Hall, for upwards of 30 years. I have frequently visited Esholt Hall, both as a friend and professionally.

9620. Do you remember the river Aire well during that period of 30 years?—Yes.

9621. In what condition was it when you first knew it?—I used to hear no complaints about it, and I presume it was pure in those days.

9622. In what condition is the river now?—It is filthy; it might be worse, but it is very bad.

9623. Is it in any way injurious, in your judgment, to the estate of your client?—My client's estate consists of 2,000 acres, and the river flows through it for about five miles. Esholt Hall is a remarkably picturesque and beautiful seat, and the value of the whole is most materially deteriorated by the state of the water.

9624. Have you any idea what would be the saleable value of that estate?—Of course it is plain that a great per centage would be deducted if anybody wished to buy it under present circumstances, and a great number of persons would refuse to live there at all. I may mention that Mr. Stansfield himself, from the impurity of the water as one cause, for I admit that it was not the only one, and from increase of population, and increase of manufacturers, has been obliged to leave this ancestral home of his, and to take up his quarters in the south of England. He was succeeded by Mr. Fairbairn, the present mayor of Leeds, who inhabited the house for a couple of years, and from my conversations with him I have reason to believe that he left the house almost exclusively on account of the impure state of the water.

9625. Is it fair to ask you what rental Mr. Fairbairn paid?—It was not a very high rental. I suppose there can be no objection to my mentioning it; he paid 200*l.* a year for the house.

9626. Had he the use of the gardens?—Yes, and the pleasure grounds.

9627. And the privilege of shooting?—Yes; but the shooting is not very valuable.

9628. That would be considered, I suppose, a very low rental for the place?—Unquestionably; and if it had not been for the state of the water, the house, considering that it was well furnished, would have let for a great deal more. Mr. Fairbairn has also a large establishment in Leeds, and requires to be a convenient distance from Leeds. Mr. Mitchell, the present tenant, is a merchant here, and it is convenient for him to be at that distance from Bradford, the distance being about five miles.

9629. In point of time what distance is it from Leeds?—It is about a quarter of an hour's walk to the station, and about five miles either way by railway.

9630. Are there any manufactories near to the boundaries of the estate?—Yes, there are; there are two upon the estate; but Mr. Mitchell and I have walked from Bradford to Esholt Hall, and have seen the condition of the beck, and we have not the slightest doubt that Bradford beck is the main offender, which contributes the most to the extremely filthy state of the water.

9631. Since you first knew Yorkshire, within the last 30 years, both population and trade have very largely increased?—Yes.

9632. With that general increase of trade and population, there has been a corresponding increase in this particular district?—No doubt.

9633. Has not trade increased even in a larger ratio than population?—I think there can be no doubt of that, from the evidence you heard yesterday.

9634. Do you know what the value of land is for manufacturing purposes; it was stated to be about 5*s.* and 7*s.* 6*d.* a square yard; what is it per acre?—5*d.* a square yard is 100*l.* an acre.

9635. 1*s.* a square yard would be about 240*l.* an acre?—Yes.

9636. What is that land worth per acre in its present state for agricultural purposes, or for residential purposes?—Mr. Stansfield's estate of course is all valuable; about the river side there is land for grazing purposes, but now of course it is a good deal deteriorated by the state of the water; but if Mr. Stansfield chose to subdivide his estate and sell it in lots, the whole of the lots adjoining the river would be most materially depreciated in value by the state of the water.

9637. You mean for residential purposes?—Yes; but I have come here chiefly to show that a fine estate is being destroyed by the state of the water, and that the law at present leaves Mr. Stansfield, as the owner of that estate, utterly helpless in the matter. It is of course known to everybody that 20 years user enables pollutions of this sort to be continued, and this is a curious thing. I have heard from the gamekeeper and others that 20 years ago, when Bradford was certainly

a large place, the water was clear, and therefore the pollutions of Bradford have been coming into the river since 20 years ago, which shows what a length of time it takes to get a river thoroughly polluted. I believe that that is the experience of everybody with regard to the river Thames. On the river Thames, with a million of population on its banks, it was a very long time before the smell was found peculiarly offensive, and so it is with the river Aire; the pollution has been going on for 20 or 30 years; but it is now very offensive. We cannot turn round upon the Bradford people and say, within the last 20 years you have destroyed our water, for it has been growing during the whole of the time. It is, I consider, a disorder which requires to be dealt with in some other way than that which the law now provides.

9638. You think it advisable, if it can be proved to be practicable, that means should be adopted to remedy the existing pollution, and to check the increase of pollution which is likely to take place?—Unquestionably, for if pollutions go on in the same degree as they have heretofore done, the river, as it appears to me, in 20 years time will become perfectly pestilential.

9639. You are speaking as a solicitor, understanding the law, and you say that at the present time it is insufficient to prevent these pollutions?—I consider that the law is utterly inoperative to meet a case of this sort.

9640. Therefore you think that the legislature ought to have its attention directed to this perplexing state of the law and amend it, if possible?—Exactly. I may mention, with regard to two becks that you have heard of, the Guiseley and Yeadon becks, which rise in the villages of those names, about a mile and a half higher up than Esholt Hall, and which becks both flow through the pleasure grounds and form exceedingly beautiful features to it, that Mr. Stansfield, as a neighbour, is a kindly-disposed man, and he has probably allowed more pollutions to have gone on than he might have done; the law perhaps might have helped him; but out of regard to struggling neighbours and honest enterprising manufacturers, who club together and knock up mills, he has been more lenient and considerate than he might have been; and although the Guiseley water is not in a very bad state in consequence of the soak ponds, yet it is rather worse than it might have been in consequence of Mr. Stansfield's lenient disposition, for I may say that to put the law in force under such circumstances requires an effort and rather a harsh disposition. It is felt to be hard upon a man to be obliged to be a sort of executioner of his poor neighbours in enforcing his own rights. The law might be improved in that respect. With regard to the state of the river, that is a growing evil, and has been growing so long in the dark that Mr. Stansfield could not protect himself. But in regard to those becks, he might have prevented contamination to a certain extent, but having a disposition to oblige, and to assist the industry of his neighbours, I own that he did not exercise his rights to the extent that he might have done, and he suffers accordingly. At the same time it is rather hard that a man should suffer for leniency of disposition, and in all respects I think the law relating to these matters might be improved.

9641. Do you know of any other estates in the county of York, or in the valleys of the Aire and Calder, which are similarly affected to those of Mr. Stansfield?—Of course it must be obvious to anyone who travels by railway from Bradford to Leeds that the river Aire is so affected; but Mr. Stansfield, I believe, is the largest proprietor on the river banks between Leeds and Bradford.

9642. Has any notice of action been given for the purpose of trying the question as to preventing pollutions of the river?—We have brought actions against the people at Guiseley, which was the occasion of their making those soak ponds, and in reference to the people of Bradford our patience was at last exhausted. We have written to the town clerk, and we gave him notice that we required the corporation to do what their Act says they ought to do; if you will allow me I will refer you to their Improvement Act, which tells them what they ought to do, and what we consider they have neglected to do; it is the Bradford Improvement Act of 1850, and the clauses to which I would refer you are 31 and 32; the first clause gives them power to cleanse the streams, and it says, "It is enacted that it shall be lawful for the corporation, as they may think fit, to cleanse the Bradford "brook or any other brook," &c. (*reading the clause*). Further powers are also given by the 32d clause. As you will hear from the officers of the corporation, they have not stirred a single step in that direction so as to mitigate the evil which their great town occasions. Moreover, I have also intimated to the town clerk, as may be seen by the reports in the newspapers, that injunctions have been granted by the Court of Chancery in cases as at Blackburn, where the sewage of towns has been brought by the authorities under the powers granted for improving their towns to a concentrated point, and so let fall into a stream or river. I have informed the town clerk also that when this great system of sewerage, to which Mr. Gott alluded, is thoroughly completed, and the whole of Bradford sewage is brought to a head and flushed into the beck and so into the river Aire, then will be the time when Mr. Stansfield will most likely feel it to be his most unpleasant duty to apply to the Court of Chancery for an injunction; that is the state of things at the present time. It appears to me that what Parliament has done for the drainage of districts is adding to the evil as to rivers. I find that the local boards are the great sinners with regard to concentrating the drainage upon those points where it may fall into the nearest running stream, and this is the case with Bradford. All these public bodies seem to think that if they can get rid of the nuisance it is no business of theirs to consider what is to become of it, and it appears to me that it is a duty which Parliament should impose upon all these local boards, to whom the preservation of the public health is committed, to look beyond their own districts and not to send their sewage beyond them, without making a provision for its purification, as far as they can, by soak ponds or otherwise; and the suggestion which I think I ought to make as a legal one is, that inasmuch as for the purpose of purification of sewage, soak ponds and appliances of that sort are wanted in various places, and frequently in small places, it is only due to the community at large that Parliament should appoint official valuers to value for every body, and to estimate what is to be paid for those easements of land that may be required, rather than put public bodies to the expense of proceeding under the Lands Clauses Act, the machinery of which is found to be so expensive and also so dilatory I think that if the public are obliged to submit to these requirements there should be public valuers appointed for the purpose of doing justice between the parties.

9643. I presume you would not like to hand over local boards or corporations to the tender mercies of arbitrators, umpire, and witnesses?—If there were only a few large cesspools that were wanted, it would be very well to leave it to the present state of the law; but as there are a great many of these easements required, I think there should be an improvement in the law. Whatever parliamentary regulations may be made in virtue of recommendations from the Commissioners, I think the penalties should be all enforcible under the summary jurisdiction of magistrates, instead of being left, as now, recoverable by actions at law.

9644. Is the estate we have been speaking of at all affected by the smoke of the district?—Yes; but there is no special complaint to make on that ground.

9645. Are there any minerals underneath the surface?—Yes; there is some very valuable slate under a portion of it.

9646. Not coals or iron stone?—There is iron clay on a certain part of the property, on the other side of the river.

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9647. Is there any fire brick clay?—Yes.

9648. But no coals?—No; at least they are so exceedingly thin that they are not worked.

9649. The estate is not likely to come into the market as a mineral estate?—No; its destination would more likely be for villas, or a large portion of it.

9650. (*Mr. Harrison.*) Is Mr. Stansfield's property on both sides of the river?—Yes.

9651. For the whole length of five miles?—I think there are some intervals, but the gamekeeper said it was for the most of the way.

9652. Does Mr. Stansfield claim the bed of the river?—That is considered to be his by the general law; it is universally claimed by the adjoining proprietor, unless it is a navigable river.

9653. Is there much fall in the river?—Yes, a good deal.

9654. Is any use made of that for mill power?—Yes, and there might be more use made of it. There is a mill-dam in front of the hall, which adds considerably to the beauty of the place, but there is no mill there, as that would detract from the residential enjoyment.

9655. Is there no mill or manufactory of any kind upon Mr. Stansfield's property?—Yes; he has two mills of his own; one is at Esholt village, and the other is Buck mill; they are both used for cloth making, and in a small way for dyeing.

9656. To a slight extent Mr. Stansfield offends against the river as well as Bradford?—Yes, the contents of his own waterclosets go into the river.

9657. I presume you would think it right, if any measure were to be carried out, that it should affect Mr. Stansfield as well as anybody else?—Yes.

9658. (*Professor Way.*) I believe there was once an impression in courts of law, that if you contributed to a nuisance you could not complain of it?—That may be so; that is to say, if you cause a nuisance, which is anything like that of which you complain, it might be unreasonable to complain; but to say that because you empty one watercloset into the river, you should submit to the whole of the nuisance arising from Bradford, I think would be carrying the principle a little too far.

9659. Did not that dogma rule in the courts of law, that you were not justified in complaining of a nuisance if you went to the place where it was?—Yes, and that is so; for example, if a brick-kiln is erected, and you choose to erect a villa adjoining to it, you cannot complain of the smoke from the brick-kiln. Again, if there is an existing tan-yard, and you choose to build a villa adjoining to it, you cannot complain of the smell of the tan-yard.

9660. With regard to the user of 20 years, are you sure that that gives a right?—Yes; that is to say, it gives a right so far as to prevent your bringing an action, but it does not give a right to continue a nuisance which is injurious to health. A party may be indicted for a nuisance, as the Bradford Canal Company was indicted, but Mr. Stansfield, as an individual, loses his right to a civil action by there being an adverse user for 20 years.

9661. Do you think that the state of the beck is more the result of house drainage or of manufacturing pollution?—The discoloration of the water I presume arises more particularly from dyeworks, from the great deepness of the blue color I imagine that indigo and other dyeing materials contribute very much to it; but it is perfectly clear that excrementitious matter and ashes are largely there, which I think the corporation of Bradford and the authorities might very easily utilize. Supposing that all solid and excrementitious matters were made available and useful by means of scavengers, and that they were removed in carts, as in Paris and other places, the water then would be comparatively without smell. One objection that my learned friend, Mr. McGowen, the town clerk, made yesterday was, that if these large soak ponds were constructed, persons in the neighbourhood might bring an indictment alleging the pond to be a nuisance, but there would not be much smell from water not containing solid impurities, and merely discolored by dyeworks.

9662. What is the best means, to keep the beck clear from the first, or, fouling it, to take it into settling ponds?—You cannot possibly keep the water quite clean, and therefore you might have settling ponds. Sending all the sludge into settling ponds is quite out of the question; you can only let discolored liquid go into the settling ponds; there will still be matter which will settle.

9663. If it were possible to purify the water before it comes into Mr. Stansfield's estate, it would not be any great benefit to the town of Bradford itself?—It is a principle to be applied to every town. I should say that Mr. Stansfield suffers, and the owners of the river Aire suffer, from the impurities of Bingley, and Shipley, and Keighley to some extent. As I have said before, as it took 20 years and upwards to make the pollutions from Bradford sensibly felt, it may take 20 years before Keighley, Bingley, and Shipley cause a similar amount of pollution. It must take a great number of years before pollution rises to be offensive in so large a stream as the river Thames. The corporation of Bradford have never made any propositions to mitigate the evil. I have no authority from Mr. Stansfield for saying so, but if the corporation were to say to him, "We want a piece of "ground of yours which will be suitable for one of "these ponds," perhaps Mr. Stansfield might be willing to meet them reasonably on the subject, but the corporation have done nothing, and the truth is that they want driving, as everybody does to do their duty in the matter.

9664. (*Mr. Harrison.*) If the corporation wanted land for irrigation purposes, would Mr. Stansfield be willing to give it them?—I think it is quite possible.

9665. Mr. Ferrand stated at Leeds that the river opposite to his property was much injured by the refuse from Keighley raising the bed of the river in times of flood, but some of the witnesses examined here have stated that that was not the case opposite to Esholt Hall?—I am not aware that the banks have been raised by it there to any great extent.

9666. There is no complaint here similar to that of Mr. Ferrand's, at Leeds?—I have not heard of it. Mr. Ferrand's complaints bear the same proportion to ours, that Keighley and Bingley in point of size bear to Bradford.

9667. I take it that Keighley, Bingley, Shipley, and Saltaire all add to the pollutions of which you complain as well as Bradford?—Yes; Mr. Mitchell and I walked from Esholt Hall to Bradford, and looked at the river above the confluence of the Bradford beck, and we found that the pollution above the confluence point was comparatively trifling.

9668. Is it fair to charge Bradford with all the condensed pollutions that pass Esholt Hall; are not Shipley, Keighley, Bingley, Silsden, Steeton, Kildwick, Coningley, Skipton, and many other places contributors to the general nuisance?—I have just mentioned that Mr. Mitchell, the present tenant of Esholt Hall, and I took particular pains to ascertain the principal causes of the pollution, to see what proportion came from Bradford beck and what came down the river higher up than the confluence of the Bradford beck, and we found that the proportion which came from Bradford beck was overwhelming, and that positively at the other side of Shipley the water was comparatively, although not perfectly pure. I mean just above the confluence, at the other side of the bridge.

9669. How many times have you made this examination?—Personally, I only went once.

9670. The places which you have named are manufacturing districts, and they contribute of course their amount of pollution?—Of course they do.

9671. With regard to the effect upon the property you have spoken of, I believe Mr. Stansfield is living, but was he not so badly affected by rheumatism that he

was compelled to go to the south of England?—I should say that during the last 20 years Mr. Stansfield has been suffering annoyance from the state of the river water; it was certainly not rheumatism by itself which induced him to leave Esholt; I admit the truth and the whole truth, which is, that in addition to suffering from the nuisance of the water, he was affected by a new railway being made.

9672. The Esholt estate I believe is at an angle, formed by the confluence of the Bradford beck and the Yeadon beck?—No; there is no confluence at all.

9673. Does not the Yeadon beck run down one side of the estate?—This and the Guiseley beck run through the estate, from the north, into the river near Esholt.

9674. Does not the Yeadon beck run through the estate and join the Bradford beck at the corner?—No.

9675. Where does the Yeadon beck go to?—It falls into the river near Esholt Hall.

9676. What river?—The Aire.

9677. Into which the Bradford beck and other streams go?—Yes; the Bradford beck flows into the river Aire, three miles from Esholt Hall.

9678. Is it not the fact that on that Yeadon beck there are mills and dyeworks, but there are no gas works?—Unquestionably. We do not say that the Guiseley beck and the Yeadon beck do not add their *quotas*, and we say that Mr. Stansfield's own water-closets also do so.

9679. Is not he proprietor of the dyeworks?—Mr. Stansfield has two mills on the Yeadon beck.

9680. Are there not some corn mills which belong to Mr. Stansfield?—Mr. Stansfield has two corn mills upon the Yeadon beck, and I saw the day before yesterday a miller, who said that he had a sick person lying in his house, whose illness was mainly attributable to the effluvia arising from that beck.

9681. Do you mean the Yeadon beck?—Yes.

9682. That beck passes through the estate?—Yes, through a portion of it. We do not say that the Bradford people are the only offenders.

9683. In your communications with the town clerk and the corporation, you have been treated with the civility that you might expect?—Yes, nothing could be more courteous.

The witness withdrew.

Mr. John Rust Jeffery (Bradford) examined.

Mr. J. R. Jeffery.

9684. (*Chairman.*) You are a solicitor?—Yes.

9685. You are a member of a firm in Bradford?—Yes, Messrs. Taylor, Jeffery, and Littler. Before giving what little evidence I have to give I should like just to say that although my firm have acted in the matter of the prosecution of the canal company, yet personally I have not had the conduct of the proceedings, and therefore I am not so intimate with the details as I should wish to be, but I can give you a general outline of what has taken place, and I can procure or hand in documents which probably will be sufficient to give you an insight into the case.

9686. We are informed that an indictment was preferred at the Leeds assizes on the 10th of August 1864 against the proprietors of the canal and their lessees?—Yes.

9687. Was there or not a true bill found?—Yes, a true bill was found by the grand jury.

9688. What then became of the trial?—It was removed by *certiorari* to the Court of Queen's Bench, and it was sent down again for trial at the assizes on the civil side, that was in the spring of 1865.

9689. Was evidence gone into to any extent?—No, but a verdict was taken by consent, subject to a special case for the opinion of the court.

9690. Was the special case argued?—Yes, it was on the 10th of June 1865, and the judges were unanimous in giving their decision in favour of the crown.

9691. What subsequent proceedings were then taken?—Since then an information has been filed at the suit of the attorney-general in chancery, praying for an injunction "That the defendants may be re-
"strained by the order and injunction of this honorable
"court from diverting into the said canal or allowing to
"pass into the same, or collecting or keeping or con-
"tinuing therein, any filth, sewage, or polluted matter or
"water, so as to be a nuisance to the inhabitants of the
"streets or any of the streets of the town of Bradford,
"or of the said buildings and suburban residences, or
"any of them, or to the persons passing along the said
"public streets and highways or any of them."

9692. Can you put in any papers connected with the case?—I can put in this information. I have written to London for affidavits and a complete set of the papers, but I have not yet received them. I will put them in subsequently. I will read to the Commissioners one passage in Mr. Leather's affidavit which was filed in support of the information. The deponent says "The Bradford beck receives nearly all the sewage
"of Bradford, most of which flows into it above the
"point at which the canal supply is taken; the water
"there is rather to be called sewage than water; it is
"in a most foul and offensive state, and wholly unfit
"for supplying the canal, as the water in the canal
"necessarily remains for a length of time nearly
"stagnant, and becomes putrescent if there is much
"foul water in it. The upper part of the Bradford
"canal is at present in as foul a state as it is possible
"to conceive."

9693. That is an extract from Mr. Leather's affidavit?—Yes.

9694. Do you consider that that is a true statement?—Certainly.

9695. Did the judge consider it so?—Yes; this was used on the application being made for an injunction. The information was filed on the 10th of June 1865, and the motion for the injunction was postponed, but a certain order was made, providing for the flushing of the canal once a fortnight, with a view to mitigating the evil. Finally, the motion again came on on the 16th of March last, and an injunction was then granted, a copy of which I have, and I will put it in. The injunction was not to take effect until the 8th of the present month, in order to enable the canal company to make certain arrangements for doing away with the nuisance, but on the 8th of this month the proprietors of the canal applied for an extension of the time in order to enable them to make some arrangement with the Leeds and Liverpool Canal Company, and I believe they expect to dispose of the canal, which is then to be supplied with water, and that will do away with the nuisance. The application is postponed until to-morrow; it will come on again before the vice-chancellor to-morrow. Affidavits have been filed, and it is not impossible that if the commission should be sitting on Friday next, we might hear that the canal had been shut up. I may observe that the indictment was prosecuted at the instance of a number of gentlemen in the town. I do not know whether the corporation had power or not to prevent, but at all events no such power was put in force, and therefore it was determined by those gentlemen to prosecute those proceedings, and they did so in a public spirited manner.

9696. Had you any precedent for the step or any leading cases to guide you in instituting the proceedings against the canal company?—I do not think that we had; it is rather looked upon as a precedent. The Bridgewater Canal Company watched it with great interest, or rather so did some persons intending to prosecute the Bridgewater Canal Company, and intending to use it as a precedent.

9697. Instead of your following any precedent, you appear to have established one?—I think so. I am not aware of any particular precedent that was followed, but the proceedings have been most successful.

9698. (*Mr. Harrison.*) Was the ground taken this,

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that the condition of the canal was injurious to health?—The complaint made was that it was a public nuisance, because the smell was so dreadful in summer time, and was becoming greater every year.

9699. (*Chairman.*) Did the gentlemen who sought for the injunction make application to the corporation to take the question up at first?—I am not aware whether they did, but the matter has been brought under the notice of the corporation very frequently—I may say continually.

9700. I think you stated that the gentlemen who joined in the application to the Court of Chancery were members of the corporation?—Some of them were.

9701. They chose to take action in their individual capacity rather than in their corporate capacity?—The corporation never would take action in the matter as a corporation.

9702. Individual members of the corporation joined other gentlemen in starting the proceedings?—Yes; that is to say, it did not originate with members of the corporation, but members of the corporation, as individuals, were parties to the proceedings. It was adopted as the best means. I may observe that the proprietors of the canal had no statutory power to take water from the beck. They had statutory power to take water from other becks, not the Bradford beck; and that was one of the points raised on the special case; but the judges decided that "whether their powers were statutory or not, they had no right to create a public nuisance." They had also a right to make reservoirs under their Act of Parliament, which they had not made. These proceedings, of course, have involved considerable expense—some 2,500*l.* or more.

9703. Will the law costs be paid by subscription among the gentlemen who took the proceedings?—Yes, they will. The canal company have had to pay the taxed costs in the chancery proceedings only.

9704. (*Mr. Harrison.*) What was the date of the Act of Parliament that was obtained for the canal?—It was obtained in the reign of George III.; it is referred to in the amended information.

9705. The canal company had powers given to them to take water from certain becks, but not from the Bradford beck?—Yes.

9706. And to form reservoirs for the supply of the canal which they have not made?—Yes.

9707. They did not take water from those becks?—They took it from those becks, and they also took it from the Bradford beck.

9708. They took it in a great measure from the Bradford beck, but they had no statutory power to take it?—Yes.

9709. Therefore they cannot turn round upon the corporation and say, "You had powers given to you to "purify the water, but you did not do it; you are the "offenders, and not we?"—Exactly.

The witness withdrew.

Mr. H. Slee.

Mr. Henry Slee (Bradford) examined.

9710. (*Chairman.*) You are a tanner?—I am; my tannery is not by any means large in comparison with such tanneries as you find in Leeds.

9711. Where are your works situated?—In Chapel Lane, Bradford.

9712. Are your works on the margin of the beck?—I believe that our refuse goes into the beck ultimately.

9713. Do you use steam power?—Only for heating the water, and not for creating heat for any other purpose.

9714. What number of tan pits have you?—Perhaps 40.

9715. How many skins or hides do you tan in a year?—I have not come prepared with statistics, but I should say that I tan about 3,000 hides in a year.

9716. What are the skins which you tan?—English hides from ordinary cattle.

9717. Do you tan any foreign hides?—None at all.

9718. You tan English hides of bullocks and cows?—Yes.

9719. Do you tan any calves hides?—No.

9720. Or sheep skins?—No.

9721. Where do you obtain water?—From the corporation.

9722. What do you pay per 1,000 gallons?—My consumption in a year is not more than 300,000 gallons.

9723. Do you tan with bark?—We tan with bark and various other tanning materials.

9724. With oak bark?—Yes; and sumach and gambia, and all the ordinary materials.

9725. What weight of tanning materials do you use?—I cannot give you the quantity; if I had been asked beforehand, I would readily have furnished the information.

9726. What is oak bark now worth a ton?—It depends upon its state, whether it is chopped or ground.

9727. Take both states?—6*l.* would be the price of it chopped, and perhaps 8*l.* or 8*l.* 10*s.* for it ground.

9728. What becomes of your spent bark?—We either consume it or throw it out into the street, and it is fetched away; it is given away; we get rid of it in the best way that we can, and we make so small a quantity that we find no difficulty about it.

9729. You do not throw it into the beck?—By no means.

9730. How many limeing pits have you?—Three.

9731. What do you do with the refuse from the lime?—It is put among the bark, and we pay somebody so much a load to fetch it away.

9732. Is there any glue making upon your premises?—No.

9733. Do you sell any of the refuse for glue making?—We do.

9734. Is the hair sold?—Yes, for plastering work, or for manufacturing purposes.

9735. For felting into carpets?—Yes.

9736. Then so far as you know you pass no refuse into the Bradford beck but the fluid?—None whatever.

9737. How frequently do you empty your tan pits?—It depends upon the waste. As the liquor gets spent, it is run away in the ordinary course of business, but there is no special time fixed for it to go away, either to-day or to-morrow.

9738. Have you had any complaints of your works from your neighbours?—None.

9739. Is not tanning considered rather unwholesome?—I do not feel much effect from it, and I have been amongst it all my life.

9740. You finish the hides completely upon your premises?—Yes; for the purpose for which they are formed.

9741. Have you drying sheds where you complete them?—Yes; we are curriers and leather merchants as well as tanners.

9742. For what is your leather principally used?—It is used for mill purposes, for saddlery purposes, and for shoe purposes, both tops and bottoms.

9743. Do you tan any pig skins?—No.

9744. Where are pig skins principally tanned?—Chiefly either in Ireland or in Edinburgh; large quantities are tanned in Edinburgh.

9745. Where do the pig skins come from?—I could not state that as a rule, but there are not so many tanned now as there used to be.

9746. Do your skins lose much in weight in the tanning process?—They do; but the proportions I am not prepared to state.

9747. A hide would not weigh so much when it had been treated as when it was green?—Certainly not, by a considerable quantity.

9748. You do not deal with dry hides which are brought in from South America and other parts of the world?—I do not.

9749. They, I believe, would gain in weight?—If they were dried hides, they would, I suppose, be salted hides.

9750. Of what age are the hides generally when they come to you?—As a rule, if we get them from the Bradford Market, they are very likely only a few hours old; but if we get them from Liverpool, Manchester, Leeds, or other places, there is the time occupied in the transit.

9751. Do they come in with the tails complete?—Not always; the tails are occasionally taken out.

9752. In the case of those hides which came in with the tails, is the material which makes oxtail soup your perquisite, or the perquisite of the men?—It is no perquisite of the men.

9753. You have the tails skinned?—Yes, and I either sell them or use them. If they are unfit for human food, they are destroyed.

9754. They are buried or put away?—Yes.

9755. Do they frequently come in in such a state as to be unfit for human food?—They do not, because if they did so the hide would come in damaged; when the tail is damaged the hide would be damaged.

9756. Do you sell the tails at so much per pound, or so much per tail?—I do not know that I ever sold one in my life. We sometimes buy hides in the market by auction, and then the tails are taken off at the auction, and so much a tail is allowed.

9757. Is there a ready sale for them?—I should say so.

9758. Of as many as you can make?—Yes.

9759. (*Mr. Harrison.*) Do you know any cases where the lime water has been applied to irrigation?—I do not.

9760. I presume that the lime water and the animal matter in it would be beneficial to the land rather than otherwise?—No doubt, lime in particular. If we could keep the lime apart from our other dirt and refuse, it would then be very useful.

9761. Some of the foreign hides come to England salted very heavily?—They do.

9762. That salt might, if put on as an over dose, be injurious to land; you have nothing of that sort?—No, it is very insignificant.

9763. Would the tan water be at all injurious?—I am not sufficiently a chemist to know that, but I should say by no means.

9764. You think that it would be harmless?—I should say perfectly harmless.

9765. One way of getting rid of the tan water and the hide water would be to let it go upon the land?—Yes.

9766. Have you ever erected tanks for the purpose of allowing the material in the tan water to subside, and then let the liquid run off clear into the river?—I have not.

9767. Do you know cases where that has been done?—No.

The witness withdrew.

Mr. William Gordon Thompson (Bradford) examined.

Mr. W. G. Thompson.

9768. (*Chairman.*) You are a soap maker?—I am.

9769. Have you soap waste grease establishments?—Yes.

9770. Where are your soap works situated?—In the Canal Road.

9771. Near to the canal of which we have been hearing?—Yes, close to it.

9772. How long have they been situated there?—Those works have been there about 12 years.

9773. What number of men do you employ?—From 12 to 15.

9774. What weight of soap do you make per annum?—About 400 tons.

9775. What are the ingredients which you use in your soap making?—Oil, and potash, and tallow.

9776. Any resin?—No resin.

9777. Is it a peculiar sort of soap?—No, simply a soft soap which is used here.

9778. You do not make soap for domestic uses?—No, we do not make any hard soap.

9779. What amount of solid refuse have you from your soap making, and of what character is it?—It is potash and lime refuse; we use it for manure.

9780. Have you any liquid?—None, excepting from the grease works.

9781. Where do you get the soap suds with which you deal?—From Messrs. Thomas, Ambler, and Sons.

9782. Are they manufacturers in Bradford?—They are spinners and manufacturers.

9783. Are they dyers?—No.

9784. What quantity of soap suds do you get from them?—About 30 tons a week.

9785. Where are those works situated?—In Thornton Road.

9786. Is that near to the river or to the beck?—They are near to the beck.

9787. Do you deal with the soap suds of more than one establishment?—Yes.

9788. Of how many establishments do you deal with the soap suds?—Near Halifax we have two places.

9789. Do you know what quantity you take?—Our quantity is extremely small compared with other makers.

9790. What weight of material do you get in the extract per annum?—About 150 tons.

9791. What is it used for?—For distillation.

9792. Do you distil it?—No.

9793. Is it passed away to other parties?—It is.

9794. (*Professor Way.*) Do you contract for takingsoap suds of manufacturers?—Yes.

9795. I suppose that the process by which you separate the oil is sufficiently simple; you add some sulphuric acid?—Yes.

9796. Is it an expensive process?—It is rather so.

9797. Is it the acid which makes it expensive, or the manipulation?—It is the acid principally.

9798. What quantity of acid do you use in a year or per 1,000 gallons of soap water?—About half a gallon of acid to a ton of water is what we use.

9799. A gallon of acid weighs 15 lbs.?—Yes.

9800. That would be 15 lbs. of acid to 1,100 lbs. of water?—Yes.

9801. Do you get the whole of the soap suds water, or only the richest parts of it?—The whole of it.

9802. All the wash water?—Yes.

9803. Do you perform the operation at your own works, or at the works of the other people?—At the works of the people where we have plant. We also have plant for purifying the water before we run it away.

9804. In what state does the water leave the works after you have done with it?—If it is not quite bright it is nearly so; it is neutral; there is very little acid about it.

9805. That is to say you use as much acid as is necessary to neutralize the alkali of the soap?—Yes, if we can.

9806. That is the object which you have?—Yes.

9807. Do you use heat at all?—No.

9808. That, I believe, is out of your reach?—Yes, it is under a patent.

9809. You cannot do it without license from Messrs. Teall?—Just so. We prefer the hot process to the cold one.

9810. (*Chairman.*) Would you not use the hot one if you could?—In most cases we should do so. We can do it by paying the royalty.

9811. (*Professor Way.*) Does the liquid stand for any time for separation after the acid is added?—Yes.

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9812. For how long?—21 hours.

9813. A part of it, I suppose, comes up to the top?—Yes, and a part goes to the bottom.

9814. Is it the rubbish and dirt which goes to the bottom?—Yes; the lighter part floats, and the heavier part, containing sand, falls to the bottom.

9815. The quantity of acid which you use is very much smaller than it would be if the whole of the grease was in a state of soap; the grease is not all in a state of soap?—It is not.

9816. There is a part which has been used as oil?—Yes.

9817. And there is the other portion which has been used in a state of soap?—Yes.

9818. Therefore the quantity of acid which you employ is not at all a gauge of the quantity of grease which you get out, is it?—That is a question. If there was no soap used, and we simply had to separate the oil from the water which comes from the wool washing, then the quantity of acid would be considerably less; it is owing to the potash contained in the soft soap that the quantity of acid is so great.

9819. Has it ever been attempted to make a lime soap?—I believe that it has.

9820. And to separate it by mechanical treatment?—Yes.

9821. Would not it form a curdy mass which you might more easily separate from the water?—Yes, but the quantity of acid to neutralize it would be considerably greater.

9822. That is on account of the quantity of oil which is not in the soap?—Yes.

9823. Otherwise no more acid would be required after it had been converted into a lime soap than before?—No, because the combination is equal.

9824. I ask you that question because the success of the soap process in separating the oil and grease is not very great, so far as purification is concerned?—No.

9825. It may be a sufficient success as a question of economy?—Precisely so.

9826. Has any means occurred to you by which you could get a better result, so far as regards clearing the water?—If we let all the water which we pass away run through lime it would be perfectly bright and neutral. We do it to a great extent.

9827. Supposing that you had another tank in which you could separate the liquid, could you deal with it and make it bright?—We do so. We find it practicable.

9828. And I suppose that no objection can be found to that liquid passing into the stream?—I believe none whatever.

9829. Do you know Needham's press?—I do not.

9830. It is a press which is formed in compartments, and in which substances to be separated from the liquid in which they are suspended are forced into chambers lined with cloth; the liquid passes away, and the solid comes out like oil cake?—I do not know it.

9831. Do you think that it would be practicable to deal with the deposited matter of your grease works by such a method as that?—I think that it would be very doubtful, because, although the colour of the water may be dark, it does not follow that there is any solid matter in it whatever; it may be merely in solution.

9832. Supposing that there is matter in suspension, which by degrees subsides in tanks, would it be possible in your opinion to separate it by any pressure like this, much more rapidly and in a much smaller space?—It is possible that it might be done.

9833. Has your attention been drawn to that?—No.

9834. It is the fact that such a process is being used very largely for separating, for instance, clay from water. I suppose that one of the great difficulties in carrying out your business is the room required for tanks?—Yes.

9835. Manufacturers object to adopt any purification process upon that ground?—Yes, in many cases.

9836. Consequently if the space required for the process were reduced there would be much more prospect of the process being universally adopted?—There is no doubt of it.

9837. In these cases do you pay for the grease recovered, or do you pay so much per annum?—So much per annum.

9838. May we ask you what that amount is?—It is so much upon every pack of soap consumed; if they consume 10 packs of soap a week, we pay so much per pack. A pack is 256 lbs. The price we pay varies from 3*s.* to 5*s.* per pack; it is a matter of arrangement.

9839. (*Chairman.*) What is a pack of soap worth?—From 3*l.* to 4*l.* We pay from 1-12th to 1-14th of the original cost.

9840. (*Professor Way.*) You do not calculate the oil consumed as any part of the business?—No; it is simply on the soap. If they use more oil in the wool scouring, it is so much the better for us.

9841. Do you think that you get anything like the full quantity of grease?—We have an impression that we do so.

9842. We have been informed by one or two dyers that they use as much as from 60 to 70 tons of oil in a year, at the price of about 60*l.* per ton, besides perhaps about 1,000*l.* worth of soap?—Yes.

9843. If you got the whole or anything like the whole of that, you could pay them a very much larger sum than you do?—Yes, but it is impossible to do so. In operating upon it you reduce it very considerably; there is a certain part of the oil which must be soluble in the water which runs away.

9844. Do you not think that improved methods of treatment might give you an improved product in quantity, and enable you to pay a larger price with advantage to yourself for the treatment of the soapsuds?—I question it.

9845. If you could recover a considerable portion, or any fair per centage of the oil which the manufacturers use, they would be better able to deal with the liquids?—Certainly, but a great part of the oil we do not have at all; all the oil which is used for moistening the tops (and it is very considerable) we never see.

9846. Are not the goods washed subsequently?—No, tops are not washed after they are made.

9847. What are tops?—After the washing of the wool the tops are spun into yarns.

9848. Are not the goods passed through soap after that?—I believe not.

9849. We have been told that a portion of the oil goes away in what they call food, that is, the spent waste or shoddy?—That is so.

9850. Do you not deal with the scouring process?—No.

9851. In a large mill something like 5,000*l.* worth of oil and soap is used in a year?—Yes.

9852. And our object is to ascertain how much of that could be profitably recovered so as to enable manufacturers to deal with the liquids?—Precisely.

9853. (*Mr. Harrison.*) Do you take the whole of the water which is used from the manufacturer, or do you merely take the best part of it?—We have to take the whole of it.

9854. Is that the case at all the manufactories where you take the soap refuse?—In every case without exception.

9855. Have you no power to stop the pumping at a certain point?—Yes, we could do so, but the waters are mixed, and therefore we should lose by doing it.

9856. Therefore you take the whole?—Yes, we are compelled to do so. In some cases we can avoid taking the washing of the bowls, but not in every case.

9857. (*Professor Way.*) Do you use bags in compressing the grease?—We do.

9858. Is one press in one factory sufficient?—No, we have no presses in any factories; we have only one operation upon our water, and the raw material is made into grease at the valley works.

9859. But in some cases presses are put down upon the premises?—Yes.

9860. Are the bags made of coarse canvas?—Yes.

9861. Do they last long?—No, they last for a very short time.

9862. (*Chairman.*) If the effluent water, after taking the grease from the top and the sediment from the bottom, were allowed to stand, would it decompose?—I think that there are elements of decomposition in it.

The witness withdrew.

Mr. George Henry Leather (Bradford) examined.

Mr. G. H. Leather.

9863. (*Chairman.*) Are you resident in Bradford?—I reside at Bingley, near Bradford, but my place of business is in Bradford.

9864. What business do you carry on?—I carry on two businesses; I am a worsted spinner and a vitriol maker.

9865. What number of hands do you employ at the worsted spinning works?—I should think nearly 600.

9866. What kind of conveniences have they in the shape of privies or waterclosets?—They have privies.

9867. Does any of the refuse pass into the beck?—I think none.

9868. Are the privies emptied, and is the refuse carted away by yourselves?—The liquid is all taken by the cloth dressers; as regards the solid, we occasionally empty out the tanks when they require it, and we take it away on to the land.

9869. As worsted spinners, you do not pollute the beck by that form of refuse?—No.

9870. Do you dye?—No.

9871. You simply spin?—Yes.

9872. Have you any waste refuse in the operation of spinning?—The suds from the washing of the wool.

9873. What do you do with the suds?—They go to the works of Teall and Le Paige, which are close by me.

9874. Then you do not pollute the beck by that water?—No; it runs in iron pipes from my works.

9875. What weight of soap do you use in a year?—I use about 15 packs a month, 180 packs a year.

9876. What amount do you get from your waste soap washing?—I get 3*s.* on every pack of soap which I consume. I could get more, but I supply Messrs. Teall and Co. very largely with vitriol, and therefore I do not press the matter. I began with that price, and have never altered it.

9877. Where are your works situated?—Close to the canal; they are in Dixon Street, on the upper side of the canal.

9878. Have you suffered any inconvenience in your works from the polluted state of that canal?—Yes, we have smelt it at times. We have had two very dry summers, but the canal has very much improved in the last few years compared with what it was eight or ten years ago, before Messrs. Teall and Company commenced their works.

9879. (*Professor Way.*) Where are your vitriol works situated?—Close on the canal, close to the mill.

9880. You make oil of vitriol?—Yes, sulphuric acid. I supply the grease extractors with immense quantities of it.

9881. Do you use pyrites?—No; the carriage would be too much.

9882. Have you more than one chamber?—Yes.

9883. Are you a large manufacturer?—Yes, I turn out about 136,000 lbs. of vitriol in a week.

9884. Do you find that you get 3 lbs. of vitriol for 1 lb. of sulphur?—We get more of the brown acid.

9885. Do you discharge anything from any part of your vitriol works?—Nothing but water, water which has been used for washing dirty carboys, or anything of that kind.

9886. Those carboys have been previously used for vitriol?—Yes.

9887. The straw and the dirt get in, I suppose, in the carriage?—Yes; we rarely wash a vitriol bottle, but we sometimes get bottles back from the dyers which have been used for nitrate of iron, and a variety of purposes, and we just wash them out.

9888. But otherwise you discharge nothing from your chambers?—Nothing.

9889. As a vitriol maker, you do not require an easement into the river for the discharge of liquids?—No.

9890. If you commit a nuisance in any way, it is more likely to be by an injury to the air?—Yes, but we pretty well avoid that, for we have only one escape, and it goes into a high chimney. Some years ago we had about 32 escapes in to the atmosphere, and now we have only one. We try to save every fume which we can in every possible way.

9891. And the larger your works the more perfectly you do it?—Yes, I turn six large chambers through a seventh in order to recover all the nitre which I can; not till then do the fumes pass into an outlet.

9892. (*Chairman.*) Do you know the extent to which soap is used throughout Yorkshire for washing?—No.

9893. Do you know any cases in which they do not attempt to recover the soap?—I believe they do not in the dye houses, they do not attempt to recover the oil and soap.

9894. Do you think that much of that soap might be recovered?—I do not know in what way the dyers wash the pieces, and whether they would recover it there.

9895. (*Mr. Harrison.*) Where do you get your water from for cleansing your wool?—I have a gather of half an acre on the roof of my mill, and I collect all that water, and when we are short, we take the town's water.

9896. What quantity a day do you use?—I could not state that. The gather off the roof as nearly as possible supplies me with water; it of course can be calculated.

9897. Do you find that the smoke and the soots from the town at all get into that water?—Yes.

9898. Do you take any steps to separate it?—Yes, we have one of the large old wagon-shaped boilers, the water first flows into that, and there it settles; and then into cisterns. We have to clean out the boiler every now and then; in the course of a twelvemonth I should think that it would get from three to four inches deep with soot, and what flies about in the atmosphere.

9899. Adopting that process, are you able to get the water in a pure state for cleansing?—Yes, it becomes quite clean.

9900. Would it be sufficiently pure for domestic purposes?—It might have a little taste, but we use it in the counting-house to wash our hands with, and it is quite as bright as the town's water.

9901. What quantity of that water do you use in the course of a year?—I cannot say.

9902. What quantity of wool do you clean in the course of a year?—We vary considerably; we wash I should think about 25 packs of wool a week.

9903. Is that chiefly English wool?—Yes, it is all English wool.

9904. And that has not been washed before; what loss in weight have you in the English wool?—It varies according to the counties from which it comes, but perhaps you might say that out of 16 lbs. there would be a suckage of 3 lbs. on an average.

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9905. Can you state what volume of water you use daily in cleansing your wool?—No, I really could not do so.

9906. Do you use the machines?—Yes, washing machines, machines with rollers.

9907. What volume of water to a given weight of wool do you put into one of those machines?—A tank perhaps would hold 200 gallons, and it may be filled with water five times a day.

9908. What weight of wool would that embrace?—About five packs, I should think.

9909. The whole of the water which you use in cleansing wool passes away into the soap works?—Yes.

9910. And that is coming from different machines at different times of the day; it all goes by one pipe?—Yes; it all runs into the tanks.

9911. (*Professor Way.*) Who are your principal customers for oil of vitriol?—Messrs. Teall and Company, the grease extractors, are our principal customers, and the dyers; a large proportion goes into the agricultural districts for dissolving bones for manure.

9912. You spoke of brown acid?—Yes; that is about 17 lbs. to the gallon, and not, as Mr. Thompson said, 15 lbs.

The witness withdrew.

Mr. C. Gott.

Mr. Charles Gott (Bradford) further examined.

9913. (*Mr. Harrison.*) You were asked yesterday whether you could furnish a return of the volume of water supplied for trade purposes to different manufactories in Bradford?—Yes (*handing in a paper*).

9914. You give this paper in as that return?—That is the return, and it shews the quantity of water used by every person whom we supply with water for trade purposes; it is the last quarter's return ending September.

9915. And these quantities and the scale of charges which you hand in will give the amount which the corporation receive for water supply for trade purposes in the borough of Bradford?—Yes, for trade purposes, where water is sold by measure. There are some few little trades where we do not sell by measure, but simply charge an annual sum.

The witness withdrew.

Mr. R. Sutcliffe.

Mr. Robert Sutcliffe (Idle, near Bradford) examined.

9916. (*Chairman.*) You are a millowner at Idle?—Yes.

9917. How far is that from Bradford?—Four miles.

9918. Have you a local board at Idle?—We have a local board now; it has been established about two years.

9919. Are you a member of that local board?—I am not.

9920. What trade do you carry on at your mill?—Mine is a branch of the cotton trade, not woollen nor worsted.

9921. What number of hands do you employ?—Nearly 100.

9922. Do you use steam power?—Yes.

9923. What amount of power do you use?—About 40 or 50 horse.

9924. Do you know what weight of coal you burn per annum?—About 800 to 1,000 tons.

9925. What do you do with your ashes?—They are carted away for road purposes.

9926. They are not passed into the beck or stream?—No.

9927. Are your works situated upon any beck or stream?—Yes.

9928. What beck?—A tributary of the river Aire; it has no distinct name.

9929. Do you use much water upon your premises?—Only for condensing purposes.

9930. Then that is not a very large quantity?—No.

9931. What privy convenience have you upon your premises for your hands?—We have four outlet privies directly communicating with the mill floors, and the soil is collected in iron tanks just underneath. It in its turn is mixed with ashes and put on the turnip fields.

9932. You do not pass it into the beck?—Not at all.

9933. Do you suffer at all from pollutions from any adjoining works?—I have done so, and we have had actions at law to a considerable extent, in which I was plaintiff, against owners of adjoining fulling mills, where soakage of wool and cloth went on; the nuisances were intolerable.

9934. When and where did the action take place?—After having submitted to great inconvenience for about 12 months, I issued a writ in May 1862, and the case went to York.

9935. Who were the defendants?—The action was against Mr. Booth and his partners. The case was tried at York, and a verdict passed for the defendants upon all the issues, owing to the misdirection of the judge and the blundering of the jury. The records of the court would thoroughly substantiate my statement. We appealed to the Court of Queen's Bench. They set aside the verdict and made the rule absolute for a new trial, and Mr. Baron Martin referred the case to the late Mr. Hindmarch, the Queen's counsel, and he gave a decision for me and gave all the issues in my favour.

9936. You have proved that your remarks are correct by the subsequent proceedings?—Yes; in fact the case is an authority now in the courts, that no man has a right at common law to pollute the water. That is what Mr. Justice Wightman laid down upon the argument.

9937. Was it a very costly proceeding to you?—Mr. Hindmarch divided the costs of the award between the plaintiff and the defendants; they applied to him *in formâ pauperis*, and he divided the costs. I think that the matter cost me 700*l.*, and the other parties about 1,200*l.*, making about 2,000*l.* altogether.

9938. Was the game worth the powder and shot?—Certainly.

9939. You were satisfied that it was a beneficial proceeding to you?—Decidedly. I would do the very same thing again with the very same results staring me in the face, but, of course, you cannot calculate what juries will do, or what judges will say at *Nisi prius*.

9940. Does the river Aire flow west of Idle for four miles?—Yes, it makes a bend.

9941. Is the Aire very foul?—Yes, the manufacturers have completely spoilt the river Aire in the last 10 years.

9942. Have you paid any attention to the utilization of sewage?—Yes, a great deal.

9943. What conclusions have you formed upon that subject?—I do not think that I could speak it in half such good language as I have written down. I wrote this paper *in extenso* for the use of the commissioners.

9944. You put in this paper?—Yes. I do not think that I could add anything to it, but I should be very glad to be examined upon it.

9945. Have you seen any of the methods of utilizing sewage which have been put into operation?—I have not specially seen them, but have made them the subject of reading and observation.

9946. What conclusions have you formed as to the best methods of utilizing sewage?—I consider that water is the very best carrier for sewage matter.

9947. From the dwelling houses?—From the dwelling houses. I would separate the rainfall and flood water as far as possible from the sewage water. I would use water in its minimum quantity and in a uniform quantity, to transmit the sewage matter to a certain outlet or outfall at a convenient place.

9948. I suppose that you have read Mr. Menzies' pamphlet?—I have not read his tract, but I have seen it commented upon.

9949. You have fallen into the same groove?—Very likely. Having carried the sewage by water to the outlet, I would then discharge it into a receiving tank, or reservoir. I should not intend that tank to be a filtering reservoir, but it should be merely used as a sort of head water or reservoir for sewage matter, which would be afterwards dealt with.

9950. To extract the sediment?—No, merely as a reserve. I would then have another tank of suitable dimensions; it might be as large as this room; and I would drive by steam power the sewage matter into the second tank at the bottom. I think that Prince Albert was the first man who adopted that plan at Windsor. I would have a mixture of ashes, sand, &c., and I would thoroughly intermingle the sewage with these substances, and would allow the water after the act of deposit to escape at the top. If the water was then not thoroughly purified I would pass it in a similar manner through a second tank, which tank might have a supply of animal charcoal in it, and I think that by that means, by using the water system and the earth system, and by using both in combination with steam power, you would be able to restore the water to a state of comparative purity. I should never look for absolute purity.

9951. Have you formed any opinion as to the best method of ventilating sewers?—In 1848 or 1849 I draughted my mill cesspools straight into the chimnies, and that plan was very much liked by the inspectors.

9952. You think that it is necessary thoroughly to ventilate sewers?—I should think it advisable.

9953. (*Mr. Harrison.*) What course have the millowners who are situated on the beck above you pursued, so as to prevent the nuisance on account of which you brought an action against them?—They have done just the same as some of the people at Huddersfield did. I gave them a right of way through my property to discharge their polluted water, so long as they did not put it into the main water course before it reached my mill reservoir; they have made a culvert, and have discharged their water in another direction below the point of the mill stream where I take the water.

9954. You gave them the means of passing it by you, and left it to your neighbour below to bring another action against them if he chose?—Precisely. I merely got rid of the nuisance; the nuisance is there all the same, although I am protected from it. The plan which I have been suggesting respecting the utilization of sewage would make a sediment into a solid form, useful for arable land; and that is a very great desideratum, because you cannot always get land for irrigation purposes; you cannot, for example, get it here.

9955. (*Chairman.*) You are aware that attempts have been made to utilize sewage by solidifying it?—Yes, but I am not aware that steam power has been brought into operation to assist it.

9956. Have you ever seen the works at Leicester?—No.

9957. Or at Croydon?—No.

9958. Or at Coventry?—No.

9959. Or at Rugby?—No.

9960. Are you aware that they have all ended in commercial failure?—I am not aware whether they have or not.

9961. They have assisted in clarifying the sewage, but commercially they have ended in absolute failure?—Precisely; but I do not always consider that a person who pollutes water ought to make a commercial success in taking the filth out of it; it is a question of duty; it may be another question whether it would be advisable to establish a joint stock company for the purpose.

9962. You do not advocate it upon commercial grounds, but as a question of avoiding a public nuisance?—Yes.

9963. And you think that the scheme which you have sketched out by your evidence, and by the written documents which you have put before us, is calculated to produce that end?—I do.

9964. (*Professor Way.*) If your wish is to preserve the streams from pollution, you are going hand in hand with your duty?—My only object in coming here is to suggest anything which may be useful to the commissioners, not that I for a moment presume that I can throw much light upon a subject of this sort, which has been so much discussed; but to contribute every mite towards restoring the streams of the country to a state of comparative purity.

9965. At Leicester, and at many other towns, precipitation of sewage is attempted; and certainly the water which flows off is very much purified from the solid matter. As Mr. Rawlinson properly says, it is clarified rather than purified. In these works they have to deal with the sludge and sediment?—Yes.

9966. And they have formed only one practicable way of carrying away that sediment for agricultural uses, which is to bring the town ashes and refuse to the same spot, and to mix them with that sludge. When they so mix them they are mixing a dry stuff with the sludge, and are therefore drying up the quantity of water, and making it practicable to carry out the plan?—We find that the porosity of the ashes takes up the liquid.

9967. Will you not have a difficulty if you make the ashes as wet as the sludge which you stop?—I propose to use water in its minimum quantity.

9968. Still the whole material of your filter would be wet?—Yes, but it cannot be wet unless it absorbs what is positively filtered.

9969. When you empty your filter beds, how would you deal with the water which you take out?—I would either dry out some of the moisture, or take the stuff to the fields in its then condition.

9970. Is it not the case that the material is of very little value agriculturally?—When it is thoroughly saturated, we find it of very great value for turnip fields. I take, for instance, the privy tank from our own mills, with a mixture of soap and water and things of that sort.

9971. Do you call the emptying of a privy sewage?—Yes.

9972. Would a ton of that and a ton of Bradford sewage be of the same value agriculturally?—Certainly not.

9973. That is the question with which you are to deal?—I would reduce that quantity of water to its minimum.

9974. That is the difficulty?—Yes.

9975. Dry ashes now constitute the only means by which they can dry up the sludge in precipitating tanks, which, as the chairman has said, have been hitherto failures, and I should say not only commercially but for purposes of health. At Leicester, where tanks have been made for the purpose of stopping every portion of solid matter (upon the view that the solid matter is of value), and where they have had the best tanks irrespective of expense, people are crying out against the process and wish to abandon it?—Still it is not for them to stipulate for commercial success when they are removing a nuisance which is caused by themselves.

9976. You are going to wet your ashes, which is the only means of getting rid of the sludge?—The ashes are full of porosity; they are like a sponge. I will suppose that a stream of polluted filth comes in contact with a layer of ashes, and the sponge-like holes in the ashes become filled up with solid matter, and the longer that is continued the more will they become impregnated with solid sewage, and the more will the water be in a condition to escape.

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9977. You know that the water which you thus allowed to pass away, no matter what filtering it may go through, contains four-fifths, if not nine-tenths, of the value of the manure?—That may be so as applied to irrigation, but I should say not if the material be mixed for arable land.

9978. Where they use ashes, as at Coventry and at Leicester, in order to make the sludge into a workable condition, they get I believe from 1*s.* 6*d.* to 2*s.* a load for it. At Leicester they cannot get anything, but at Coventry the town brings the ashes to the sludge, and they cart out this material, of course using a large quantity of ashes, but even there they cannot get it sold at 2*s.* 6*d.* a ton all the year round. What manure do you think there can be in a material which can only fetch 2*s.* 6*d.* a ton?—That I cannot tell, but in the neighbourhood of Bradford you cannot get land for irrigation. If the sewage cannot be solidified, what can be done with it?

9979. (*Mr. Harrison.*) Cannot you pump?—You cannot get filtration ground.

9980. (*Chairman.*) Could not you reach land available for pumping?—That is entirely a question of cost, but my own impression is, that if you were to bring in steam power in aid of your present appliances you might have a combination of the water system nd the earth system, or employ each separately.

9981. (*Professor Way.*) You have mentioned Prince Albert's system of filtration. I happen to have gone down to Windsor, and to have seen him upon the occasion, and undoubtedly the thing is a failure?—That may be, because steam power was not brought to work it.

The witness withdrew.

Mr. J. W. Leather.

Mr. JOHN WIGNALL LEATHER (Leeds) examined.

9982. (*Chairman.*) You have been in practice as a civil engineer for many years?—Yes.

9983. Your father, who I am happy to say is still living, has practised for many years also as a civil engineer?—Yes.

9984. He was a contemporary with Mr. Telford and many eminent men of by-gone times?—Yes, he was rather younger than they. Mr. Telford was consulted upon the improvement of the Aire and Calder, my father being the acting engineer; he, and also Mr. Rennie, had been consulted previously.

9985. You have been largely engaged as a civil engineer for many years?—About 36 years, as pupil and in practice.

9986. There have been some reservoir failures in Yorkshire?—Yes.

9987. Your family or your father have had nothing to do with those failures?—With the Sheffield calamity we had nothing whatever to do. With respect to the Holmfirth calamity we had executed the reservoir which failed, but that failure was no more due to any defect in the engineering than the fact of Kirkstall Abbey being now in ruins is a reflection on the architect of that building, because it arose entirely and purely from the neglect of necessary repairs.

9988. You had designed and executed the reservoir embankment as engineers?—Yes.

9989. With certain arrangements for safely passing off flood waters?—Quite so.

9990. You had ceased to be engineers, and had passed over the works to the commissioners?—Yes.

9991. And you had ceased even to be consulted about it?—Quite so.

9992. The embankment, in course of time, as all embankments will, had subsided?—Yes.

9993. And the bye wash had not been altered to correspond with that subsidence?—No.

9994. Were you aware of that condition of things?—No.

9995. You had not been communicated with?—No.

9996. If you had been communicated with, would you have thought it your duty seriously to remonstrate against that state of things?—Certainly.

9997. That state of things existing, the failure of that embankment took place in consequence of the gross neglect of the proprietors?—Quite so.

9998. With the Sheffield failure you had nothing to do, directly or indirectly?—Neither directly nor indirectly.

9999. How many years have you known the valleys of the Aire and Calder?—Ever since I was a boy.

10,000. In what condition were the waters of those valleys when you first knew them, as compared with their present condition?—They were very much better than they are now. When I was a young man I often bathed in the Leeds and Liverpool canal, near to Spring Gardens in Leeds, where there was a plantation, but it is now quite impossible for any young man of the present day to think of such a thing as going to bathe there.

10,001. Do you recollect as to the flooding of the rivers and streams in the Aire and Calder valleys at the earlier part of your career; do you think that the floods are heavier now than they were formerly?—I think that the floods are perhaps rather less than they were formerly.

10,002. Would that be in consequence of reservoir space being made above, and of land drainage, or from what cause?—Partly, I think, from reservoirs having been made, and partly from the improvement of land drainage having laid the lands drier.

10,003. Do you think that it can be attributed to any natural causes other than those which we have spoken of, such as a failure of rainfall, or the stripping of trees, or anything of that description?—Probably, by reason of improved drainage having made the lands drier, there may have been less evaporation, and therefore less precipitation of vapour.

10,004. I suppose that with the growth of popular tion and the growth of manufactures, the rivers have become polluted from various sources, such as sewage and the waste refuse of manufactures?—Yes.

10,005. Have you been consulted professionally with regard to any of these pollutions?—I was employed in the year 1844 to devise a scheme for providing a main sewerage for the town of Leeds, and I devised a scheme which was laid before the town council, in a report, dated 10th February, 1845.

10,006. Will you briefly describe that scheme?—The principal difficulties in the way of draining the site of the town are described at pp. 25 to 27 of my report, and arose from the extreme flatness of the portion on the south side of the river, on which are Holbeck and Hunslet, and the southward of Leeds, having an area of about 900 acres, and from the alternation of certain bold ridges and hollows on the northern side, some of the ridges pushing close to the river's edge.

Captain Vetch, who had been previously consulted, very aptly describes the site of the town where he observes in his report "In many respects the situation "of Leeds resembles that of London; they are both "traversed from west to east by a river which divides "the town into two unequal portions, the northern "one being the largest; in both, the northern portion "stands on high ground and the southern on low, flat "land; and in each, in its passage through the town, "the river forms a bend to northward of similar "importance.

"The River Aire," he also observes, "in passing "through the town, forms a large bend to the north-"east, the chord of which, from Monk Bridge to "Hunslet Bar, is somewhat better than a mile and "three-quarters in length, while the curvature or "breadth of the same is somewhat more than half a "mile, and the space thus comprehended is remarkably "low and flat, and forms the principal site of the town "of Leeds, south of the river; buildings, however,

" extend to the south of the chord line, parallel to " which the rising ground commences at no great " distance ;" to which I would add that the northern part of the town is chiefly situated on the slopes of a tributary of the Aire, called the Addle Beck or Sheepscar Beck (which has its course nearly parallel with the river) and on the ridge between that beck and the river, which attains to an elevation of some 200 feet above the river.

Captain Vetch proposed to treat the two sides of the river by separate systems of sewers.

A full consideration of the question induced me to recommend that the sewerage should be kept clear of the river and becks, and carried below the town, but that the whole should be treated as one system, and that the entire sewerage should be carried to one outlet only instead of to two outlets (one on the north and the other on the south side of the river), as recommended by Captain Vetch. I gathered the whole of the waters from about 780 acres of the high-lying ridge above described (and which I called the north-western district) to one point on the northern side of the river ; then passed the sewer by which they were so collected under the King's Mills pool of the river, from the north side to the south, whereby I not only avoided the ridges which interposed the main difficulty to a continuous trunk sewer for the north side of the river, but I brought the waters of those 780 acres of high lying and generally steeply sloping streets, &c., to bear upon and afford a scour for the flat and low lying southern district, which is then traversed by the main trunk sewer, in almost the chord line of the arc formed by the river. I then pass under the river again (the Hunslet Mills Pool) and, immediately afterwards, receive the main sewer of the north-eastern or Addle Beck district, of about 720 acres ; and, thence, the main trunk proceeds forward (having received the sewers of all the three districts) to the Thorpe Mills Pool, where it enters the river some two miles below the town.

The main sewer for the north-western district is $4\frac{1}{2}$ feet by $3\frac{1}{2}$ feet, and passes under the King's Mills Pool at a depth of $14\frac{3}{4}$ feet below the ordinary water level.

The main sewer for the north-western and southern districts combined is $6\frac{1}{2}$ feet by $5\frac{1}{2}$ feet, and passes under the Hunslet Mills Pool of the river at a depth of about $12\frac{1}{3}$ feet below the ordinary water level.

The main sewer for the north-eastern or Addle Beck district is $4\frac{1}{2}$ feet by $3\frac{1}{2}$ feet.

The main trunk sewer is 7 feet 9 inches by 8 feet, brick with a stone invert, but the last 300 yards is open cut, with retaining walls, level in the bottom, and enters the Thorpe Mills Pool of the river about 3 feet below ordinary water level of that pool. Fall of main trunk is 1 in 1,634.

The crown of Thorpe Mills Pool is 28 feet below that of the King's Mills, so that the outlet of the sewer is 31 feet below the level of the King's Mills weir.

The length between the first and second crossings of the river is about 1,600 yards.

The length of the main trunk sewer is 1,550 yards from junction of Addle Beck sewer to the open cut, so that there is a fall in less than two miles of about $16\frac{1}{4}$ feet, of which about $15\frac{1}{3}$ feet is between the two crossings of the river, giving to the main sewer of the very flat and low lying southern district the satisfactory slope of 1 in 313, with a depth of $12\frac{1}{3}$ feet below ordinary surface water of the proximate pool of the river.

The 300 yards at the outlet was made open cut with a view to the utilization of the manure, or to afford facilities for purifying the sewerage by precipitation before it was put into the river.

My estimate for the main trunk and principal branch sewers, so far as the same passed along the public highways, was 80,000*l.*, and the scheme was recommended by me as the best course to be adopted on sanitary, engineering, and financial grounds. It was adopted by the Town Council, and was most favourably reported on by the surveying officers sent down by Government, in accordance with the then practice of Parliament. The Town Council afterwards decided to sewer at the public cost all streets which were thoroughfares, though not declared public highways, whereby the actual expenditure will probably be more than doubled.

The three townships of Leeds, Holbeck, and Hunslet were declared a drainage district. They have an area of about 4,490 acres, all of which contribute to the sewerage rate, though the actual district for which provision was made comprised an area of only about 2,400 acres, and of which about 940 acres only were then occupied by streets and buildings.

I am satisfied that the river and brooks at Leeds, bad as they are, would have been in a much worse condition but for the intercepting sewers, but I believe that the state of the river below the outlet of the Leeds sewers is very much worse.

10,007. Is that the scheme which has been carried out ?—Yes. There were technical difficulties in the way of carrying it out, and an Act of Parliament was necessary ; that Act was obtained in the year 1848, and I think that it was 1850 before the scheme was actually begun.

10,008. Whatever the scheme is now, it was devised by yourself, and it has been carried out as far as regards the main trunk sewers ?—Yes. The principle was to keep the sewage entirely out of the river and the brooks.

10,009. And the scheme has been devised as regards Leeds, so as to concentrate the sewage at one point ?—Yes.

10,010. And at present it is passed in block into the river Aire ?—Yes.

10,011. The fact of its being at one point would enable the Town Council of Leeds to deal with it as may be thought best in future ?—Yes. With a view to facilitating that object (as I have stated) a length of 300 yards at the end was made open cut, with retaining walls and slopes, so that, in that 300 yards, works might be adopted either to lift the water and use it for irrigation, or to make large reservoirs and precipitate the impurities, so as to carry the water purer into the river ; but nothing has been done in either direction.

10,012. Have you any statistics with regard to the valley of the Aire, showing the population and the number of persons to each acre ?—Yes ; it occurred to me in writing the report to which I have alluded, that an examination of the statistics of the river Aire and its tributaries would enable us to form some approximate notion of the comparative salubrity of the different streams ; that the pollution of the water would be in the compound proportion of the extent of surface draining into each particular stream, and the amount of population located on such surface, or in other words that the number of individuals per acre of surface would furnish an approximate expression of the quality of the water :—as, for instance, if we found the number of individuals per acre in one district to be 100, and the number of individuals per acre in another district to be only two, we might infer that the relative impurities of the water in these two districts, or the amount of impurity per gallon of water, would be in the one district represented by the number 100, and in the other district by the number 2, or as 50 to 1. With that view I abstracted the population of the valley, dividing it into districts, so as to make a comparison ; and the results of that examination, taking the population of 1841, are stated in my report. But I can give you the results as respects the population of 1861. In the table No. 1, which I now hand in, there is given every place in the valley of the Aire, with its population at each decennial period from 1801 to 1861. (*This table will be found printed at the foot of the evidence of the witness.*) I have also a map here which will give you the entire watershed of the Aire down as far as Leeds, and the places with the population marked upon them (*producing the same*). That is a map which was prepared in 1862 ; it is a lithographed map. I will leave that map with

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you; the part tinted green is the valley of the Aire, and the part tinted red is the valley of the Wharfe.

10,013. You I think originally designed the scheme of water supply which has been carried out for Bradford?—I did.

10,014. You were the engineer in chief?—Yes. I also carried out the scheme.

10,015. And you have designed waterworks for Leeds?—Yes; I executed the original works for Leeds.

10,016. And you designed extensions?—Yes; I recommended them in 1851 to go to the river Washbourn.

10,017. Is that something like the scheme which Mr. Filliter has now adopted?—I believe that it is the identical scheme, but modified to some extent.

10,018. In what respects do you conceive Mr. Filliter's to be a modification of the scheme as you proposed it?—Because they are proposing to let the water run down to the lower part of the Washbourn, and then to pump it back again; they are also proposing to take a much larger proportion of the water of the Washbourn than I think at all suitable for domestic purposes. My scheme proposed to take 6,000,000 to 10,000,000 gallons for that purpose, and they propose to get 23,000,000 gallons per day. It is quite impossible that they can get 23,000,000 gallons per day suitable for the supply of the town, and they must spend 7,000*l.* a year in pumping a portion only of that water, which money might have been much better expended in getting water coming by its own gravitation of a better quality, and at less cost.

10,019. Have you reason to suppose that the proprietors of the soil in the valley of the Washbourn and its district and in the valley of the Wharfe will favour Mr. Filliter's scheme, or will oppose it?—I believe that they will oppose it.

10,020. Had you any such scheme for the supply of Leeds from the valley of the Washbourn?—Not at that time.

10,021. Do you know the present supply per day to the population in Leeds?—I think that the consumption is now about 4,500,000 gallons per day.

10,022. How many gallons per day per head would that make, taking the population?—I have not worked that out.

10,023. It is about 16 or 18 gallons, is it not?—I think that it is more than that.

10,024. Taking out the water used for trade purposes, is it not that quantity?—It may be.

10,025. What is your usual calculation per head of the population for domestic and trade purposes in a town like Leeds?—I should take 30 gallons per head now for a town like Leeds; but then I should take the prospective increase of population into account.

10,026. Would 30 gallons be necessary, or merely desirable?—I think that it would be desirable to make a provision of 30 gallons upon the prospective population, looking forward for some 15 or 20 years.

10,027. Looking at Leeds as it is now, you would in any scheme provide for 20 years further?—Yes.

10,028. Do you think that 23,000,000 gallons per day, in addition to the present volume supplied to Leeds, is at all required or will be required in 20 years from this time, they having upwards of 30 gallons per head now?—I apprehend that they will abandon the pumping from the Wharfe, which is the source of a great portion of the present supply. They get about 1,500,000 gallons a day from the old source, what we call the Eccup source, which is the first gravitation scheme. Then we (the Waterworks Company) proposed to go for 6,000,000 gallons more from the Washbourn, but it was overruled, and the council took possession of the works and have got powers to pump the 6,000,000 gallons from the river Wharfe at Arthington instead.

10,029. Do you know the quality of that water which is pumped from the river?—I believe that, chemically examined, it does not show any very great amount of impurity.

10,030. There are some few manufacturing places above?—Yes.

10,031. If the refuse water from those places could be kept out of the river, do you think that it would be an objectionable source of supply?—Of course it passes through a large extent of cultivated land.

10,032. From what source does the Washbourn derive its waters?—Chiefly high, peaty moor land.

10,033. Is the water bright or discoloured?—It is very highly discoloured in summer and autumn, but there are times when it is very bright and colourless.

10,034. I suppose that during frosty periods it would be bright?—Yes, some of the tributaries would also be generally bright.

10,035. Do you think that water which should be always bright could be procured from the district?—I do not think that any of those waters which would come by gravitation would come at all times colourless.

10,036. (*Professor Way.*) Still you would have more chance of getting a smaller quantity colourless?—Yes; I calculate that we might have got 6,000,000 to 10,000,000 gallons colourless, and have passed the coloured and turbid water into reservoirs for compensation.

10,037. So that if the supply was considerably magnified, you would have to give up quality for the sake of quantity?—Yes.

10,038. If you take an inordinate quantity of water into a town, and have afterwards to get rid of it in the shape of sewage, it is, I suppose, an extra labour to you?—I think that it is an advantage to get a large dilution of the sewage matter with pure water.

10,039. (*Chairman.*) What is your table No. 2 (*This table will be found printed at the foot of the evidence of the witness*)?—It exhibits the population of the valley of the Aire from its source down to and including the town of Leeds and its suburbs, at the several periods at which the census has been taken, from 1801 to 1861, both inclusive; showing also the rate of increase of the population in each of the decennial periods. From this table it appears that the population of the whole valley of the Aire down to and including Leeds, Holbeck, and Hunslet, has increased $2\frac{7}{10}$ths times in 40 years up to 1841, and that it has increased nearly $3\frac{3}{4}$ times in 60 years, ending with 1861.

10,040. (*Mr. Harrison.*) Has that increase varied very much in different portions of the basin of the Aire?—Yes. The increase from 1801 to 1811 was $17\frac{1}{2}$ per cent., that is, taking the whole valley. In the 10 years ending 1821, it was 34 per cent. In 1831 it was $36\frac{2}{3}$rds per cent. In 1841 it was $25\frac{1}{3}$rd per cent. In 1851 it was $22\frac{2}{3}$rds per cent. In 1861 it was 12 per cent. I am omitting minute fractions.

10,041. Not taking the basin generally, but taking the districts which you have marked upon the plan, do you find that the increase in the several districts varies very considerably?—Very much so.

10,042. Take for instance, No. 1 district, what is the increase from 1801 to 1861?—I have not worked out that; I have not taken the districts. The first subdivision of table No. 2, is the main valley to the west end of Leeds township.

10,043. Taking the tables which you have put in, in No. 1 district, the increase of population from 1801 to 1861 is how much?—A little more than 50 per cent. in the 60 years.

10,044. Is not that a large area?—That is down to and including Skipton, 65,000 acres.

10,045. In the next district, what is the increase, and to what point does it reach?—The next district reaches to just above Keighley, where the Worth valley comes in. The increase in that district is not 100 per cent. in 60 years; the figures are not doubled.

10,046. The next district, No. 3, takes you down to Shipley, does it not?—It includes Bingley and Keighley, which are manufacturing places, and there the population has nearly trebled in the 60 years.

10,047. No. 4, which is Bradford proper, has increased how much in the 60 years?—In the 60 years it has increased more than sixfold.

10,048. It includes, and is confined pretty nearly to the Bradford beck?—That is exclusively of the valley of the Bradford beck.

10,049. The next district, which goes to the suburbs of Leeds, namely, No. 5, including Calverley, Rawden, and Apperley Bridge, and Eccleshill and Guisely, and other places, has increased to what extent?—Down to the west end of Leeds it has increased over threefold.

10,050. Or nearly the same as the district above Shipley?—Yes, that is the Keighley district.

10,051. No. 6 is a district including Armley, Pudsey, Tong, and Morley; how much has that increased?—That is the district of the Holbeck beck, and includes a little of the borough of Leeds.

10,052. How much has it increased in the 60 years?—About 3¼ times.

10,053. Then No. 7 is Leeds proper. I do not think that you have it shaded separately?—No, the subdivisions have been altered in the population returns.

10,054. What is No. 8?—No. 8 is the Leeds Addle beck district.

10,055. How far does No. 9 reach?—It includes Hunslet, below Leeds; it includes the Addle beck and the Hunslet beck below Leeds.

10,056. How much has it increased in the 60 years?—Taking Nos. 7, 8, and 9 combined, they have increased from 36,677 to nearly 150,000.

10,057. Does that include Addle and the Addle beck?—It includes the Addle beck.

10,058. In fact, it includes the valley of the Addle beck and its tributaries?—Yes.

10,059. What is the increase there?—It is more than fourfold.

10,060. No. 9 is Hunslet beck?—Yes; the three townships of Leeds, Holbeck, and Hunslet have increased from 40,664 to 159,150.

10,061. That is about fourfold?—Nearly so.

10,062. So that it shows that whereas Leeds has increased about fourfold in the 60 years, Bradford within the Bradford beck area has increased sixfold?—Yes.

10,063. And the other manufacturing portions of the valley appear to have increased about three to one?—Yes, the township of Leeds has increased 3·83-fold; the townships of Holbeck and Hunslet 4·16-fold in the 60 years, and Leeds, Holbeck, and Hunslet, taken together, 3·94-fold; the whole valley of the Aire, down to and including Leeds, Holbeck, and Hunslet, 3·70-fold. Then, Table No. 3 (*which will be found printed at the foot of the evidence of the witness*) exhibits the area of surface drained by the river Aire at several points of its course down to and including the town of Leeds and its suburbs, the amount of population residing on such surface, and the average number of individuals per acre in the year 1861, exhibiting also the same particulars as respects its tributaries, the Bradfordbeck, the Pudsey or Holbeck beck, and the Addle beck. From this table it appears that the Skipton district drains 65,000 acres, with a population of only 12,733, giving 0·196 individuals per acre, that is, giving upwards of five acres to an individual.

10,064. How would you describe the geology of the portion No. 1?—The north side would be mountain limestone, and the south side millstone grit.

10,065. That is not a district to which attention has been much drawn as a source of water supply?—No.

10,066. What is the reason why that large area has not been drawn upon at all as a source of water supply for the district below?—The hardness of the water, I think, has been the cause.

10,067. Have you taken any gaugings of the volume of water coming down the river at these different places?—No.

10,068. (*Professor Way.*) Roughly, how much water is contributed by the mountain limestone; is it a third of the whole river?—I should think nothing approaching one third.

10,069. Do you know it to be very hard water?—I have never tested it in any way.

10,070. But you would suppose it to be hard water?—I know that in the upper reaches of the Wharfe the water is found on analysis not to be nearly so hard as I should have conceived it would have been, although it is from the same mountain limestone.

10,071. The general character of the water of the ridge on this side, as well as of the Wharfe water, is soft, is it not?—It is about 11 degrees of hardness, whereas the Thames water is about 14 to 18 degrees of hardness: but the Washbourn water is only from two to four degrees, varying with the seasons, the Washbourn water being entirely from the millstone grit.

10,072. (*Mr. Harrison.*) What are the circumstances of district No. 2?—I do not make calculations for each district separately, but keep accumulating the results down the valley, so as to give the state of the valley at each point. The Bradford beck district, including Bradford town, has a drainage area of 13,100 acres, and a population of 126,484 individuals, giving 9·655 individuals per acre. The population has increased in the whole valley thus far to 1·342 individuals per acre, as compared with 0·196 in the Skipton district. Then the Holbeck beck, which enters the river at Leeds, drains 16,000 acres; it brings the sewage from 74,037 persons, giving 4·627 individuals per acre, the population of the whole valley to this point being represented by 1·79 individuals per acre.

10,073. Is that about half the population per acre as compared with the population in the area of Bradford beck?—Yes; but just below Bradford town the Bradford beck has drained 11,000 acres, with a population of 115,181 persons, giving 10·471 individuals per acre, or nearly 10½, that is, excluding the lower portion of the Bradford beck, and taking it just below the town of Bradford. Addle beck, when it reaches Sheepscar bridge, has drained 9,000 acres, with a population of 23,931 persons, or 2·659 individuals per acre; but, on entering the river at Leeds, where it has taken a large portion of Leeds town, it has drained only 9,500 acres, with a population of 87,520 individuals, or at the rate of 9·213 persons per acre. The ultimate result, therefore, is that the river Aire, on entering the district, is the drain of 170,300 acres, and has received the sewage of 259,385 persons, and, that on leaving the district, it has become the sewer of 479,409 persons, and the impurity has become that of 2·404 individuals per acre.

10,074. (*Professor Way.*) To avoid any mistake, would you go further, and say that these different districts receive the sewage of so many people?—Yes.

10,075. Your calculation is simply of the number of persons to the acre?—Yes.

10,076. Without any reference to whether they do or do not discharge their sewage?—Yes, it is an assumption.

10,077. You do not ascertain the actual area drained or sewered at this moment?—Not absolutely by means of sewers.

10,078. Supposing the whole of the population to drain into these rivers, that would be the result?—Yes.

10,079. (*Mr. Harrison.*) These remarks as to population would simply refer to the question of sewage, and would be no guide as to pollution from manufactures?—Just so; but I presume that those impurities will be somewhat in proportion to the population of the district; probably they will be to a somewhat larger degree than the population of the district, that is to say, that a population like that of the Bradford beck will probably put a larger amount of impurities into the stream per individual than the population of the Skipton district.

10,080. A few years ago a great deal of the dyeing of Bradford materials used to be carried on at Leeds?—A great part of it is still carried on at Leeds.

10,081. But the dyeworks at Bradford have increased immensely in the last few years, and they are a great source of pollution?—Yes.

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10,082. And the number of people employed in the dyeworks is small as compared with other manufactories. Some of the manufactories in Bradford, employing a vast number of persons, send no pollution into the river at all from the manufactories themselves?—No, but the impurities from dyeworks and manufactories would be represented to some extent by the population.

10,083. So far as sewage goes?—Yes, and also to some extent as respects trade purposes.

10,084. (*Professor Way.*) The persons forming that very population are engaged in work in which they pollute the river, so that the population, instead of being a measure of the pollution as in a non-manufacturing district, respresents a very much greater pollution?—Quite so.

10,085. You could not compare 10,000 people living in a mere trading town with 10,000 people living in a manufacturing town; the sewage would be the same, but the refuse which they would make and pass into the stream would be very different?—Quite so.

10,086. (*Mr. Harrison.*) Have you had an opportunity of gauging the volume of water passing out of the Aire and Calder respectively?—No.

10,087. How long have you known the Bradford beck?—I was born at Bradford, and I have known the Bradford beck ever since I was a child. I have known it when it had minnows in it.

10,088. A minnow would have a poor chance now?—Yes.

10,089. In what condition were the tributaries of the Bradford beck then?—They were quite bright and pure.

10,090. What is the condition of the Bradford beck now?—It is one of the most polluted streams which I know anywhere.

10,091. Have you had anything to do with the Bradford canal?—I was concerned in proceedings which were taken by the inhabitants of Bradford, to obtain an injunction as to the Canal Company's using that water.

10,092. Were you engaged in that case on the part of the inhabitants?—Yes.

10,093. There was no case for the Canal Company to stand upon?—No, except user. I suppose they would rely a little on prescriptive right; that was overruled, and it did not prevail in that case; they were held to be doing an illegal act.

10,094. Have you any remarks to make on the Bradford canal case?—No.

10,095. How does the canal in its present condition affect the value of property adjoining it?—If the water were bright and pure, I imagine the property would be much increased in value; its present condition has a depreciating effect upon the value of property along its course.

10,096. Have you been able to obtain any statistics as to the Calder, as in the case of the Aire?—I have made an abstract for 1851 and 1861 of the valley of the Calder, down to its junction with the Aire at Castleford. It drains 253,850 acres, and in 1861 it had a population of 432,917. (*These statistics will be found printed in Table No. 4 at the foot of the evidence of the witness.*)

10,097. As against how many in the valley of the Aire?—My analysis of the statistics of the valley of the Aire extends only down to Leeds; that is shown in table No. 3, and there is not a very great difference between it and the valley of the Calder. The worst of the tributaries of the Calder is the Hebble brook, which drains Halifax; it has only 7,100 acres of gathering ground, and drains 51,488 persons. In 1861 there were at the rate of $7\frac{1}{4}$ individuals per acre.

10,098. Have you got a table shewing the increase in the population in different parts of the valley of the Calder?—In 1851 and in 1861, not before. In 1851 the total population was 387,990, and in 1861 it was 432,917, shewing an increase of about 46,000. I was surprised to find that the river Calder, at the Wakefield waterworks pumping station in 1861, represented by this arbitrary rule, was in as bad a state as the river Aire was below Leeds in 1841.

10,099. Can you give the area of the Aire at Leeds, and the area of the Calder at Wakefield, and the population in the two cases in 1861?—The area of the Aire, below Leeds, is 191,400 acres, and the population is 479,409, giving 2·404 individuals. Now the Calder, below Wakefield, has an area of 241,450 acres, and a population of 418,706 persons, giving 1·734 individuals per acre.

10,100. Do you know the condition of the river Aire below Leeds, and of the Calder below Wakefield, now?—I have not seen the Calder below Wakefield for some years, not since we executed works for the improvement of the navigation.

10,101. I believe you have the means of comparing and putting in juxtaposition the area of the Hebble basin at and below Halifax, and the area of the Bradford beck at and below Bradford, with the population in each case?—The Hebble brook has 7,100 acres, and in 1861 it had 51,488 persons, giving 7·251 individuals per acre. The Bradford beck, down to its confluence with the Aire, has 13,130 acres, and a population of 126,484, giving 9·65 individuals per acre.

10,102. Although both of those becks would be extensively polluted, yet the proportion of pollution would be rather in favour of Halifax?—Yes. The river Colne, including Huddersfield, has only 1·919 individuals per acre; and taking it down to its confluence with the Calder, only 1·574 individuals per acre.

10,103. There is a large area above Huddersfield, is there not?—Yes; it drains 44,800 acres, including Huddersfield.

10,104. Now take Todmorden; does that pollute the stream much on which it stands?—It is in the upper part of the district. The population in 1861 was less than 1 person per acre down to Halifax, where the Hebble enters the Calder, the drainage is 68,940 acres, with a population of 63,465 persons, showing 0·920 individuals to an acre. It is worse than the Aire just before the entrance of the Bradford beck, including Keighley and Bingley; for, up to that point there are only 0·518 individuals per acre. After receiving the Bradford beck, the rate is only 1·342 per acre.

10,105. Can you state what is the area of the gathering ground above Todmorden?—No; I have not taken that out, but it would be very much less than this quantity, and the population would be relatively as large. There are some populous places, such as Hebden Bridge and Sowerby Bridge, below.

10,106. The population of the whole district of the Aire and Calder valleys is rapidly increasing, is it not?—Yes, very rapidly.

10,107. And that increase is the result of the increase of manufactures?—Yes.

10,108. It appears from your evidence that the pollution within your memory has increased very much indeed. In the Aire and Calder themselves, and especially in some of the tributaries, such as the Hebble and the Bradford becks?—Yes.

10,109. If manufactories go on further, the nuisance will become, of course, greater every year?—Yes.

10,110. Do you consider that some steps should be taken to prevent this increase of pollution?—I do. It is very important that some preventive measure should be adopted, but I think there may be considerable difficulties in carrying them out in crowded towns. I believe that the dyers have almost crowded up all their space, and have scarcely room left for filtration or precipitation; but I think that something might be done in the way of precipitating the solid parts of the dye wares.

10,111. Have you directed your attention specially to the subject, and can you suggest any means of preventing this pollution?—In the districts unbuilt upon there should be some supervision before trade premises are allowed to be erected on the banks of streams. The districts ought to be placed under a special control,

wholly unconnected with the locality. Neither town councils, nor boards of health, nor even river commissions, are suitable bodies for the purpose; that is to say, when elected by the inhabitants of the districts. The streams ought to be put under some independent inspectors, such as the factory inspectors, or the inspectors of mines, or even a higher class of men than those possibly, and better paid. Their duties would be more important; they would be required to possess scientific skill and more independence of action.

10,112. How would you deal with a case like Bradford, for I am afraid it would be almost impossible for any inspectors to search out all the sources of pollution?—I do not see that there would be any greater difficulty in inspectors finding out the evil than in the authorities finding it out; possibly in many cases the authorities are the wrong doers.

10,113. (*Professor Way.*) If the corporation of Bradford carry out a system of sewerage, and allow individuals to pour their refuse into the sewers, you might probably bring an action against the corporation for polluting the brook by the refuse coming out of the sewers?—There ought to be some measure by which they should be compelled to purify the sewage to some extent before it passed into the streams.

10,114. From your knowledge of the whole district, do you think there would be any difficulty in obtaining land for the purposes of irrigation?—There would be a difficulty, I think, in the case of Bradford, in getting a sufficient quantity for irrigation purposes—a great difficulty. I do not know of any large areas of land lying favorably for useful irrigation from the Bradford sewers.

10,115. You say that you have carried out waterworks in connection with Bradford?—Yes.

10,116. Before a large quantity of water is brought to a town in a confined district, such as the Bradford beck area, below Bradford, to be polluted in the town, should not some condition be made under which the authorities should undertake to distribute the sewage and the polluted water either by irrigation or otherwise, and not allow it to pass down the river and become an increasing cause of annoyance to the people below the town?—It is, no doubt, desirable that something should be done to purify the sewage before it passes into living streams, but bringing a large quantity of pure water to the town must dilute the impurities, and therefore must be beneficial rather than otherwise.

10,117. If the water were brought into a pure state, and it was so poured into the brook, your argument would be good, but if it is brought in polluted I do not see that the argument holds good at all?—The same amount of impurities would find their way into the brook in either case, but if a greater quantity of pure water were brought in, that water would tend to some extent to qualify the impurities.

10,118. If it was a question of rendering it as little noxious as possible, the greater the dilution the better; but on the other hand there is the proposition that in order to purify impure water the less you have to purify the better?—Yes.

10,119. To refer again to the water supply of towns, I presume that if it be desirable that the polluted water of towns should be kept out of the streams which pass through those towns, it would be also desirable that no excessive quantity of water should be carried into those towns to be polluted?—I suppose so.

10,120. If you had to deal with that water afterwards, the more closely you can restrict its use, so long as it effects the purpose for which you have used it, the more likely you will be to purify your stream?—You would have a smaller volume to deal with, but it would be a more concentrated essence.

10,121. Volume I believe means cost?—Yes, it does to some extent in filtration and precipitation.

10,122. If it is a fact that that water must be passed into the river, the more diluted it is the better?—Yes.

10,123. If it is resolved to keep it out of the river, the less water you deal with the better?—Yes.

10,124. Consequently the question of sewage will affect the question of the future water supply?—Yes, in that way it will.

10,125. I thought you said that in the case of Leeds the proposition was to bring in 23,000,000 of gallons to satisfy such a population as there will be 30 years hence, whereas you have formed the opinion that 10,000,000 of gallons are at present adequate?—Yes, or for a long time to come.

10,126. If that were so, might we not assume that the 23,000,000 of gallons to be dealt with as sewage would cost twice as much as 10,000,000 of gallons?—Yes, undoubtedly, if it had to be lifted or treated in any way.

10,127. Again, in a natural state of things every inhabitant of a country would seek for his water at the nearest stream to the spot where he had settled down?—Yes.

10,128. Consequently the distribution of the inhabitants and the distribution of the water supply would be in parallel directions; where there were most inhabitants there would necessarily be a supply adequate to their wants?—That is the natural course of events.

10,129. If you go for 25,000,000 of gallons of water, and monopolise all that water unnecessarily, taking more than is required for your rightful consumption, even supposing you did not interfere with the existing population, would you not *pro tanto* prevent the rise of population in districts which you deprived of their water?—No, I do not think that that follows in all cases, because a district may be unsuitable to the growth of a manufacturing population, on account of the distance that coal may have to be conveyed.

10,130. Take the case of the Wharfe, would not the railway now projected along its margin be likely to open out the valley as a manufacturing district?—I think the population there would be increased very materially, but not in the higher reaches of the Wharfe.

10,131. If you were to take a large quantity of water from the higher reaches of the Wharfe would you not *pro tanto* diminish the chances of population springing up on the banks of that river?—I do not think that that follows, because wherever a waterworks company or a corporation take water from the Wharfe, we are bound to provide compensation in water for the millowners, which really is more than an equivalent.

10,132. That is to say, compensation for the millowners who have mills there or who will have mills prospectively?—It compensates them all in time; it compensates the river.

10,133. Does it compensate the non-existing millers?—It improves the flow of the river in a dry season, and that is a benefit not only to those existing there now, but to all those who may come there for trade purposes.

10,134. Do you think it a right and proper thing for a town to take more water than it really wants by monopolizing these sources of supply?—I think it is for the authorities or for the company themselves to judge whether they are taking more than they want.

10,135. If it were a very wrong thing, I suppose it would not be attempted?—No. I think it is right to look forward to some distant period, and not to limit the draught to the mere present necessity, because it entails very great additional cost to have to go to Parliament again in a very short time, and that is necessary where a scheme of stunted proportions has been adopted.

10,136. Do you think that a water supply ought not to be just what can be obtained, but that it ought to be restricted to what is really necessary?—Yes, taking a prospective view of the probable increase of the district.

10,137. If 10,000,000 gallons would be sufficient, would you seek for power to take 25,000,000 gallons?—No, I think that would be unreasonable.

10,138. (*Mr. Harrison.*) I believe you have been engineer for several reservoirs in this neighbourhood?—Yes.

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10,139. Have you prepared any statistics as to the rainfall within the basins of the Aire and Calder that you can put in?—I have got the rainfall at several places in the district, but I think you have had that laid before you.

10,140. (*Chairman.*) Is it not given in the documents that you laid before me upon the Bradford inquiry after the Daledyke disaster?—I am not quite sure of it, but I can supply you with the rain returns of the district.

10,141. (*Mr. Harrison.*) Are you well acquainted with the river Aire throughout its course?—Yes.

10,142. Do you know that part of it which has been improved by a number of landed proprietors?—Yes.

10,143. Have you observed what has been done, and do you believe that they are actual improvements?—I have not seen them since they were executed.

10,144. (*Professor Way.*) Do you know the springs at Hewenden?—Yes.

10,145. What do you call them?—The Manywell springs.

10,146. The water is peculiarly good, is it not?—Yes, it is beautiful water; it has scarcely two degrees of hardness, I believe.

10,147. From what strata does it come?—From the millstone grit.

10,148. From some particular bed?—Yes.

10,149. Do you know the Stubden reservoir?—Yes.

10,150. Is that much the same kind of water?—It is very nearly as pure, and of about the same hardness.

10,151. It contains more organic matter; do you think that is from the peat?—Yes, probably so. There is a little peat on the little stream that comes down.

10,152. Do you know any means of keeping that peat out?—No; I do not think it prevails there to any serious extent.

10,153. It gives a tint to the water, does it not?—Yes, at times there is a slight tint, but I believe it is very good water.

10,154. (*Chairman.*) You have a mechanical arrangement in your conduits, have you not, for turning to waste any water that you wish to reject?—Yes, we can do that.

10,155. And by mechanical arrangement only?—Yes.

10,156. Have you any detailed drawings of the arrangement you have adopted?—I think I have at Leeds; it is a very simple, self-acting arrangement.

10,157. Is it something in the shape of a throttle-valve?—There is a certain width of opening like this (*explaining by a sketch*).

10,158. If I recollect rightly, there is besides that an iron flap that you can turn down?—Yes, by that we can either increase the width of the opening or can close it entirely.

10,159. In devising a scheme for the water supply of Bradford or Leeds, what volume per day would you take as a basis for domestic and trade consumption?—30 gallons per head, taking a prospective view of the population.

10,160. Have you formed any idea of the number of gallons per head which are legitimately used?—I have no means of separating the trade uses from the total consumption.

10,161. Do you know whether any portion of the water that is passed into a town, such as Bradford and Leeds, is wasted by the inhabitants or by imperfect apparatus, leaking joints, bad taps, taps left open, and neglect of various kinds?—There is great waste of water from neglected apparatus in the towns generally.

10,162. Is is your opinion that at present in towns generally there is a very large amount of waste?—I think there is.

10,163. From one cause and another?—Yes.

10,164. A more perfect method of distribution, if it could be discovered, would utilize a portion of that waste?—Yes.

10,165. What proportion of water is given in compensation to the streams under the Bradford scheme as compared with the volume taken from them?—In the Bradford scheme I have departed from the usual course. The usual course is to give compensation upon the same streams that the water is taken from. The millowners then become the first takers; that is to say, they are guaranteed a certain proportion, which is considered to be about one-third of the total estimated flow, and the town takes nothing until the millowners are secured their third. It has often happened from over-estimates that the town has not really got so much as the millowners have got; but in the Bradford case I have treated the matter differently. I gave the millowners a reservoir upon an independent gathering ground; I gave it up to them to do as they pleased with it. That reservoir was capable of containing about 630,000,000 gallons, and we calculate upon getting from the valley of the Wharfe from 8,000,000 to 10,000,000 gallons per day. Of course our springs are entirely without any first takers. We have all that we can draw from the gathering ground, without any first takers or any guarantee to the mills. They have a reservoir, and they draw from that as they please.

10,166. In speaking of one-third of any area, do you mean one-third of the gauged flow from the ground or one-third of the calculated average rainfall?—The general custom is to assume a certain rainfall, and deduct a proportion for evaporation and loss, and then give a third of the net proceeds of an average year.

10,167. Do you think that that has hitherto been a fair proportion for the companies to give?—I think it has been a boon to the millowners rather than to the companies.

10,168. You diminish the liability to stoppage from floods, by giving them a regular flow in a dry season?—Yes.

10,169. Have you been at all professionally concerned in the Manchester or the Liverpool waterworks?—I opposed the Liverpool waterworks when the Liverpool people were going for an alteration of their line.

10,170. Is it the fact that they have been compelled to buy off by money compensations that which they had guaranteed to supply, in consequence of having a scarcity of water?—I think that they have done that at Manchester.

10,171. And at Liverpool also?—I am not aware hat they have.

10,172. Would that indicate to you that the compensation water had been over estimated by the engineers at first?—Yes. I think that the yield had been over estimated. There is great temptation to over estimate the yield, because one set of engineers first shew that they are going to get a large supply for a small sum of money, and then other engineers come to oppose their scheme, and they over estimate the yield, in order to get as much as they can for the millowners in way of compensation.

10,173. Would you take it, that the engineer is required to have his estimate of volume upon the lowest known rainfall of any 12 months?—I think the millowners would not submit to his doing that; they would insist upon a certain average being taken.

10,174. If an engineer is to secure to his district a certain supply of water, is it not necessary that he should know what would be the driest year that he could possibly have to pass through?—It is very desirable that he should have a view to the driest time.

10,175. Are you aware that the people of Liverpool were promised 16,000,000 gallons a day?—I have understood they were.

10,176. And that in several years the supply has fallen below 9,000,000 a day?—I have seen that stated in a report by Mr. Duncan.

10,177. Was not the volume over estimated in that case?—Yes. I think very likely it was.

10,178. Is it likely to have been over estimated because averages were dealt with instead of dry seasons?—Yes, and possibly also because a larger volume was taken than was found in practice to be given out.

10,179. Would you not infer from that, that it was much safer to ascertain the driest known season, and take that as the basis for the supply?—Yes, it would be safer if it would be submitted to by the parties interested in the streams.

10,180. If these facts were laid before a committee in Parliament, would they not deal with them as facts, especially if the districts had suffered severely in consequence of miscalculations?—I think the system I have adopted of giving an independent reservoir and independent gathering ground, is by far the safest way. Engineers came who represented that the proper capacity of a compensation reservoir for the Wharfe district was between 1,300,000,000 and 1,400,000,000 gallons. I gave a reservoir capable of containing only 650,000,000. There were clauses referring it to Sir William Cubitt, who was to say whether it was an equivalent; if not, he was to cut off certain streams which we were not to take, until we had provided what he said was an equivalent; his award was that a reservoir capable of containing 625,000,000 gallons was an equivalent.

10,181. Have you had much to do with Sir William Cubitt?—Not very much.

10,182. Did you not find that he was rather in advance of his period, and that he was inclined to take a broad and liberal view of things?—Yes.

10,183. You might have had your scheme submitted to a man who would have dealt with it very differently, might you not?—Yes.

10,184. If you take the driest possible period to base your supply upon, I suppose on the other side the wettest season must be taken, and the greatest possible amount of rainfall in the shortest time, as the test to which your works will have to submit in times of flood water; I mean your bye-wash space for the delivery from your reservoir, must be capable of accommodating the largest volume of water that can come in the shortest time?—Yes, quite so. I laid out the works, so that the largest possible quantity would not rise two feet above the sill of the waste weir; the reservoir bank is six feet above the sill of the weir.

10,185. Do you remember what volume a minute you calculated would come in a flood from each 100 acres?—About 30 cubic feet per second from each 100 acres.

10,186. Has that been ascertained from gaugings, or is it only speculative?—From observations.

10,187. Have you any large works, which are subject to that volume of water?—We never have had so large a flood as that. (*The witness subsequently informed the Commission that on November* 16, 1866, *there occurred one of the highest floods ever known in the district, there being nothing higher on record since* 1775. *At Doe Park Reservoir the water rose* 16 *inches over the sill of the waste pit, two* 18*-inch valves being also open; at Stubden Reservoir the entire flood passed down the waste water channels, and was not admitted into the reservoir at all; at Barden Reservoir the same; at Grimwith Reservoir the flood ran* 18 *inches over the sill of the waste weir; and at Hewenden Reservoir it ran* 25 *inches over the sill of the waste weir, there being at this reservoir the discharge from the two* 18*-inch valves at Doe Park, in addition to the volume of the flood itself.*)

10,188. Have you provided for a larger flood than ever you have known?—Yes.

10,189. What is the largest flood you have known?—I have never heard of water rising more than about a foot over the waste weirs of any of these reservoirs; having executed the works I leave them, and they are not under my management any longer.

10,190. Do you remember what has been the largest rainfall that you have ever had to deal with, or heard of in this country?—I think somewhat over two inches have fallen in an hour at Kendal; Doctor Dalton, I think, instances that rainfall.

10,191. Would you be surprised to hear that in Birmingham in 1855 1·90 inches fell in half an hour?—That was a very extraordinary fall.

10,192. If an engineer knows that he is subject to that kind of risk, he would be, I suppose, anxious to provide for it in bye-wash room?—Yes.

10,193. In some of your works you have laid out bye-wash space in the solid, and in some the valve wall forms the bye-wash?—Yes.

10,194. After the great experience you have had, if you had to begin again and you were about to lay down rules for reservoirs, which of those should you prefer?—I think it would partly depend upon the situation and the cost.

10,195. Do you like quite as well to throw the water over the top of the vertical shaft as to send it down a bye-wash in the solid?—I think that where the area of the drainage ground is very large I should not throw the water over the top of the vertical shaft. In the case of 5,000 or 6,000 acres of gathering ground certainly not, but up to 2,000 acres I rather prefer to use that mode of dealing with the waste.

10,196. You mean the vertical shaft?—Yes.

10,197. Does not that, for the time being, interfere with your valve?—No; the gangway by which the valves are drawn is raised above the overfall of the well.

10,198. The power of the water to do mischief would be in proportion to the volume and the height from which it fell?—Yes, to some extent.

10,199. If it falls 30 to 40 feet you must have a proportionate mass of masonry to receive the shock?—Yes.

10,200. If you have your bye-wash on the solid, you may lift it in four-feet lifts as you may think right?—Yes, and take it in small steps.

10,201. Would you prefer, in making your bye-washes, to take it down in steps or from a shoot?—By steps.

10,202. Letting the water gradually down?—Yes.

10,203. So that the velocity would be no greater at the last step than at the first?—No.

10,204. With a long shoot in a fall of 100 feet, the accelerated velocity below would be greater than the velocity of the water outgoing from the reservoir?—Yes.

10,205. And it would be more destructive?—Yes, or liable to be so.

10,206. In forming reservoirs where you have a head of 70 or 90 feet, would you prefer to place the valves at the bottom, or would you have intermediate means of drawing off?—I should prefer the latter.

10,207. You would have several heads?—Yes, two or three heads.

10,208. These, I believe, you have provided for in your works?—Yes.

10,209. Is there anything further that you wish to add?—Yes. I might add, I think, that the brooks and streams in these very populous districts might, in my opinion, be improved by having the angles cut off and side walls and inverts adopted. I made that suggestion in my report to the Leeds town council in 1845, but nothing was done at that time. They went last session to obtain powers to do that with the Sheepscar beck and the Addle beck. I also suggested in that report that reservoirs might be formed in the upper district.

10,210. Do you remember what reports you put in before me?—I gave you Captain Veitch's report, Mr. Wickstead's report, and a rejoinder to his report from myself. I gave you also the report of the deputation that went to Manchester, Liverpool, Birmingham, and London to inquire into the general provisions that were made for flushing and ventilating sewers and other matters.

10,211. Those reports are to be taken as being put in before us to-day?—If you please; they are quite at your service. I wish to draw the attention of the Commissioners to the principle of rating for works like these for river improvements, and if you will refer to the report of the 10th of February 1845, upon the

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means of providing an effectual sewerage for the town of Leeds, at page 125, you will find this passage, "the revenue to be derived," &c. (*reading the same.*)

10,212. (*Mr. Harrison.*) Are you acquainted with the water power on the Addle beck at Leeds?—I am generally. There are several mills upon that beck.

10,213. It seemed to be difficult at the same time to preserve that water power and to keep the polluted water out of that beck?—I recommended in my report that Sheepscar mill ought to be bought, and the dam done away with as a dangerous nuisance, so as to give free scope to the beck; the Sheepscar mill pond is a great nuisance. Coals are now so cheap in that district that water power is not a great object. Mr. Holroyd, a dyer at Leeds, made an erroneous statement before you in ignorance of the facts. He stated that he attributed the diminution in the flow of water in Addle beck to the circumstance of a portion of it having been diverted to the Eccup reservoir, but that is a mistake. No part of the water of that beck has been so diverted. I think that it is attributable partly to improved drainage, and to the fact that a reservoir which they had on the Addle beck some years ago was allowed to get out of order. I think a flood broke down the dam, and it was never repaired; they were paying a certain sum a year for the use of water that was sent down this stream from that reservoir, but now they have not got that water in a dry time.

10,214. At what rate per 1,000 gallons, if extensive works for the supply of Leeds with water are carried out, do you anticipate they will be able to deliver water for trade purposes?—I suppose at about 3*d.* per 1,000 gallons; 2*d.* or 3*d.*

10,215. At the present time they pay from 6*d.* to 1*s.*?—Yes, I believe 6*d.* is their minimum.

10,216. That is a heavy charge?—Yes.

10,217. Do you suppose that if you could deliver it at 2*d.* per 1,000 gallons, it would be largely used?—Yes; no doubt it would be much more largely used.

10,218. (*Professor Way.*) Did you say that you thought the improved land drainage brought the water down more rapidly or more equably throughout the year?—I think it tends to bring the water down more rapidly in a flood.

10,219. It has been stated that land drainage has tended to equalize the water in river courses throughout the year during drought and flood. On the other hand, this opinion has been entertained that it brings the water down very rapidly in times of heavy rainfalls, leaving very little as the minimum quantity of water in the summer time?—My notion is that it brings it down more rapidly in a flood, and there is less water left in dry seasons than there was.

10,220. If you find the general opinion is, that there is less water in a drought than there used to be, you would perhaps be inclined to consider that such diminution was partly due to improved drainage?—Yes, especially in a boggy district where the bog acts as a sponge, holding up the water, and giving it out over a lengthened period.

10,221. I can instance the case of a common in Surrey, which yielded a certain quantity of water per day very regularly throughout the year, but the quantity being found too small for the supply of a town, underground drainage was carried out with the view of obtaining a larger supply; and should you be surprised to hear that in the summer season no water could be found on that common?—No. I think that that illustrates what I have just now said, that the common acted like a sponge, holding the water and giving it out by degrees; they cut through the sponge, and then they deliver the water more rapidly, and I think that would be the general result of drainage. That is the reason why water power is less valuable than it used to be.

10,222. (*Mr. Harrison.*) Is not a great part of the water that comes down a river in a very droughty season derived from deep-seated springs?—It may be so, probably, in some districts.

10,223. Do you imagine that any mere agricultural surface drainage would stay the water that goes down to those deep-seated springs, or withdraw it?—I think it might intercept some of that water.

10,224. If it is a free soil, and if there are springs out of the chalk, would any drainage in the chalk for agricultural purposes have any effect at all?—I think it is possible that it might cut off some of the water which otherwise would percolate through the chalk.

10,225. It has been stated that in the drainage of a considerable extent of land, the result of a drain passing for a short distance over chalk, and then into impervious strata was, that the water, instead of being discharged at the outlet, was passed into the chalk?—Yes.

10,226. If that was the case with water gathered from a considerable area, would it not be much more the case in ordinary agricultural drainage, where there was a large surface of chalk for the water to pass through?—If the drain passes over a stratum that would absorb the water or allow it to pass into feeders, it would be of no use putting drains in.

10,227. The deep-seated springs are at a considerable depth below the surface of such pervious land?—Yes.

10,228. No surface drainage could affect the springs that issue from such pervious strata?—No, unless they cut them out before they arrive at the point; the chalk comes quite to the surface.

10,229. I can understand the case you have put of a peat bog acting like a sponge placed upon the surface of the soil, and delivering the water out gradually, and that when it was drained the water should be taken away, and that the summer supply should be diminished. I could also understand, if there was a superficial bed of gravel, and you tapped that pretty deeply, and drew off the water, that the discharge in the summer would be diminished; but I cannot imagine that any artificial drainage in pervious strata, such as chalk, the oolites, or any free substrata, can ever diminish the summer flow?—Assuming that there was an imperfectly pervious stratum over a very pervious one, the drains might carry away from the super-stratum the water which would have gone down in time to the very pervious strata to feed the deep-seated springs; but chalk comes so near to the surface, and is so pervious, that land drains would be of no use.

10,230. Have you made any observations upon the volume of water passing down any river in this neighbourhood, taking the minimum flow, and comparing it with the rainfall in the season, so as to be able to say whether the minimum rainfall has diminished of late years?—I cannot say that I have; but it is a matter of observation amongst the millers that the water has been reduced in most of the streams of the district. The people on the Wharfe think so, and a gentleman living on the Addle beck said so at Leeds. I know that that is the general impression, and I believe that it is well founded. I attribute it to improved drainage.

10,231. Do you think that that impression can be a well-founded one, unless you go carefully into the volume of water passing down a river, and compare that with the rainfall?—No; I think it would be a vague impression that might be well founded, or it might not.

The witness withdrew.

The witness put in the following Tables.

TABLE No. 1. (referred to *supra*, Question 10,012.)

STATISTICS of the RIVER AIRE and its TRIBUTARIES.—POPULATION of the Valley of the Aire, from its source down to and including the town of Leeds and its suburbs, at the several periods at which the Census has been taken, from 1801 to 1861 both inclusive; abstracted from the published returns, and divided into districts.

No. and Name of District.	Name of Place.	1801. Population of each Place.	1801. Population of each District.	1811. Population of each Place.	1811. Population of each District.	1821. Population of each Place.	1821. Population of each District	1831. Population of each Place.	1831. Population of each District.	1841. Population of each Place.	1841. Population of each District.	1851. Population of each Place.	1851. Population of each District.	1861. Population of each Place.	1861. Population of each District.
No. 1. Skipton District.	Malham	262		306		262		259		233		188		184	
	Kirkby Malhamdale	167		175		202		219		195		139		128	
	Malham Moor	98		97		88		94		102		92		115	
	Aire Town	139		176		187		179		217		225		236	
	Otterburn	26		47		40		66		48		54		59	
	Hetton-with-Boardley	172		212		180		176		191		187		155	
	Rilston	177		192		145		115		121		123		107	
	Flasby-with-Winterburn	120		150		134		143		140		124		113	
	Eshton	84		63		69		82		74		84		81	
	Cold Coniston	342		257		345		336		242		289		238	
	Crawe ½	95		81		89		75		76		79		69	
	Gargrave	728		897		972		1,062		1,176		1,214		1,103	
	Embsy-with-Eastby	623		692		861		891		962		948		1,028	
	Sturton-with-Thorlsby	134		149		168		170		132		182		127	
	Bank Newton	68		102		139		125		129		120		108	
	Marton	393		384		464		443		381		341		256	
	Thornton-in-Craven	1,202		1,546		1,829		2,246		2,354		2,202		2,112	
	Coates ½	11		27		24		22		25		34		30	
	Barnoldswick ½	192		223		333		420		462		484		702	
	Broughton-with-Elslack	380		401		427		407		407		335		274	
	Calton	60		74		76		79		79		75		56	
	Skipton	2,305		2,868		3,411		4,181		4,842		5,044		5,454	
			7,778		9,119		10,447		11,790		12,588		12,563		12,733
No. 2 District.	Cowling	1,140		1,449		1,870		2,242		2,458		2,305		1,815	
	Bradleys Both	385		412		506		614		557		571		442	
	Farnhill-with-Cononly	876		1,045		1,350		1,567		1,618		1,853		1,369	
	Kildwick	209		216		175		190		189		206		170	
	Silsden	1,323		1,606		1,904		2,137		2,346		2,508		2,582	
	Glusburn	533		654		787		987		1,052		1,320		1,475	
	Sutton	809		953		1,092		1,153		1,292		1,660		1,699	
	Steeton-with-Eastburn	510		545		753		859		963		1,289		1,341	
			5,785		6,880		8,457		9,756		10,475		11,712		10,893
No. 3. Bingley and Keighley District.	Haworth	3,164		3,971		4,668		5,835		6,303		6,848		5,896	
	Keighley	5,745		6,864		9,223		11,176		13,413		18,239		18,819	
	Wilsden	913		1,121		1,711		2,252		2,684		3,454		2,888	
	Thornton ¼	618		754		1,025		1,492		1,697		2,013		1,907	
	Morton	838		987		1,199		1,219		1,693		1,902		2,113	
	Bingley	4,100		4,782		6,176		8,036		10,157		13,437		13,254	
			15,378		18,479		24,002		30,010		35,947		45,913		44,877
No. 4 District.	Thornton ¾	1,854		2,262		3,075		4,476		5,091		6,038		5,720	
	Clayton	2,040		2,469		3,609		4,469		4,347		5,052		5,655	
	Allerton	809		1,093		1,488		1,733		1,914		2,041		2,014	
	Horton	3,459		4,423		7,192		10,782		17,615		28,143		30,189	
	Bowling	2,055		2,226		3,579		5,958		8,918		13,538		14,494	
	Bierley ⅓	1,273		1,588		2,023		2,418		3,171		3,903		4,167	
	Manningham ⅓	4,552		532		824		1,118		1,874		3,201		4,296	
	Bradford	6,393		7,767		13,064		23,223		34,560		52,493		48,646	
	Heaton	951		1,088		1,217		1,452		1,573		1,637		1,673	
	Manningham ⅔	904		1,064		1,848		2,376		3,748		6,403		8,693	
	Bolton	474		581		634		671		683		874		937	
			20,664		25,093		38,353		58,746		83,494		123,323		126,484
No. 5 District.	Shipley	1,008		1,214		1,606		1,926		2,413		3,272		7,100	
	Baildon	1,719		2,073		2,679		3,044		3,280		3,008		3,895	
	Hawksworth	227		582		323		327		339		295		237	
	Esholt	268		—		355		404		443		397		369	
	Guisely	825		959		1,213		1,604		1,971		2,572		2,566	
	Idle	3,398		3,882		4,666		5,416		6,212		7,118		9,155	
	Eccleshill	1,351		1,608		2,176		2,570		1,308		3,700		4,482	
	Carlton ½	57		67		79		91		102		92		96	
	Yeadon	1,695		1,954		2,455		2,761		3,379		4,109		4,259	
	Rawden	1,115		1,450		1,759		2,057		2,531		2,567		2,576	
	Horsforth	2,099		2,315		2,824		3,425		4,188		4,584		5,281	
	Calverley-with-Farsley	1,127		1,296		2,005		2,637		4,142		4,892		5,559	
	Bramley ⅔	1,920		2,613		3,693		5,279		6,656		6,712		6,518	
	Armley ⅓	2,019		2,193		3,204		3,869		4,257		4,642		5,050	
	Headingley-with-Burley ⅔	984		1,251		1,614		2,887		3,576		4,579		7,255	
			19,812		23,457		31,251		38,297		46,497		52,539		64,398
No. 6. Holbeck District.	Bramley ½	640		871		1,230		1,760		2,219		2,237		2,172	
	Armley ¼	674		735		1,068		1,290		1,419		1,548		1,683	
	Pudsey	4,422		4,697		6,229		7,460		10,002		11,603		12,912	
	Tong	1,336		1,505		1,893		2,067		2,515		2,797		3,035	
	Driglington	1,232		1,365		1,719		1,676		2,046		2,740		4,274	
	Gildersome	1,232		1,409		1,592		1,652		1,917		2,126		2,701	
	Morley	2,108		2,500		3,031		3,819		4,087		4,821		6,840	
	Churwell	502		666		814		1,023		1,998		1,103		1,564	
	Beeston	1,427		1,062		1,670		2,128		2,175		1,973		2,547	
	Farnley	943		1,164		1,320		1,591		1,530		1,722		3,064	
	Wortley	1,995		2,336		3,179		5,944		7,090		7,896		12,058	
	Holbeck	4,196		5,124		7,151		11,210		13,346		14,152		15,824	
	Leeds, South Ward ⅔	2,178		2,844		4,125		4,912		4,658		5,008		5,363	
			22,885		26,278		35,033		46,532		54,202		59,726		74,037
No. 7. Leeds District.	5/16 West Ward									11,954		18,158		22,825	
	5/16 Kirkgate Ward									3,070		3,003		2,779	
	Millhill Ward									5,222		5,414		5,312	
	⅛ South Ward									1,552		1,669		1,788	
	⅜ Hunslet									5,284		6,489		8,588	
											30,082		34,738		41,292
No. 8. Leeds; Addle Beck District.	⅛ Headingley-cum-Burley									1,192		1,526		2,418	
	⅛ Carlton									103		93		96	
	⅛ Bramhope									87		98		78	
	⅛ Addle-cum-Eccup									394		341		401	
	⅛ Alwoodley									85		82		70	
	Chapeltown									2,580		2,842		3,083	
	Potternewton									1,241		1,385		1,878	
			*		*		*		*						
	⅜ N.W. Ward									8,489		9,816		13,249	
	5/16 N.E. Ward									1,815		2,159		2,658	
			36,677		42,560		56,119		83,125						
	⅛ N.W. Ward									2,122		2,454		3,312	
	5/16 N.E. Ward									16,328		19,435		23,924	
	North Ward									13,000		14,454		14,554	
	East Ward									15,530		17,421		18,954	
	1/16 West Ward									1,661		2,018		2,536	
	1/16 Kirkgate Ward									340		334		309	
											64,967		74,458		87,520
No. 9.	Hunslet Beck below Leeds									10,568	10,568	12,977	12,977	17,175	17,175
	Total		128,979		151,866		203,642		278,256		348,820		427,944		479,409

* Leeds cannot very conveniently be subdivided for these periods. The census for 1841 was made out according to the new arrangement of the town into wards for municipal purposes, and the boundaries of these wards do not coincide with the older divisions of the town.

Leeds, November 1866.

(Signed) J. W. LEATHER,

TABLE No. 2.—(Referred to *supra* Question 10,039.)

Statistics of the River Aire and its Tributaries.

Exhibiting the Population of the Valley of the Aire from its Source down to and including the Town of Leeds and its Suburbs at the several periods at which the Census has been taken from 1801 to 1861 both inclusive; showing also the Rate of Increase of the Population in each of the decimal periods—1801 to 1811; 1811 to 1821; 1821 to 1831; 1831 to 1841; 1841 to 1851; and 1851 to 1861.

Districts.	Population in 1801.	Increase per cent. between 1801 and 1811.	Population in 1811.	Increase per cent. between 1811 and 1821.	Population in 1821.	Increase per cent. between 1821 and 1831.	Population in 1831.	Increase per cent. between 1831 and 1841.	Population in 1841.	Increase per cent. between 1841 and 1851.	Population in 1851.	Increase per cent. between 1851 and 1861.	Population in 1861.	Rate of Increase.
Main Valley to the west end of Leeds Township	69,417	—	83,028	—	112,490	—	148,599	—	189,001	—	246,050	—	259,385	—
Valley of the Pudsey and Holbeck Beck, down to, but exclusive of Holbeck	16,511	—	18,310	—	23,757	—	30,410	—	36,198	—	40,566	—	52,850	—
Valley of the Addle Beck, including Chapel Allerton, and Potternewton, but exclusive of any part of the Township of Leeds	2,387	—	3,060	—	3,047	—	4,361	—	5,682	—	6,367	—	8,024	—
Total of the Valley of the Aire down to Leeds, but exclusive of Leeds, Holbeck, and Hunslet	88,315	18·21	104,398	33·83	139,717	31·25	183,370	25·91	230,881	26·89	292,983	9·31	320,259	Times. 1·65 in 20 years. 2·21 „ 30 „ 2·61 „ 40 „ 3·32 „ 50 „ 3·63 „ 60 „
Township of Leeds	30,669	17·22	35,951	35·19	48,603	47·32	71,602	23·95	88,741	14·20	101,343	16·00	117,563	1·58 in 20 years. 2·33 „ 30 „ 2·90 „ 40 „ 3·30 „ 50 „ 3·83 „ 60 „
Township of Holbeck and Hunslet	9,995	15·23	11,517	33·04	15,322	52·08	23,284	25·40	29,198	15·14	33,618	23·70	41,587	1·33 in 20 years. 2·33 „ 30 „ 2·92 „ 40 „ 3·36 „ 50 „ 4·16 „ 60 „
Leeds, Holbeck, and Hunslet	40,664	16·73	47,468	34·66	63,925	48·43	94,886	24·30	117,939	14·43	134,961	17·92	159,150	1·57 in 20 years. 2·33 „ 30 „ 2·89 „ 40 „ 3·32 „ 50 „ 3·94 „ 60 „
Total of the Valley of the Aire, including Leeds, Holbeck, and Hunslet	128,979	17·52	151,866	34·09	203,642	36·64	278,256	25·36	348,820	22·68	427,944	12·02	479,407	1·58 in 20 years. 2·15 „ 30 „ 2·70 „ 40 „ 3·32 „ 50 „ 3·70 „ 60 „

(Signed) J. W. Leather,
Leeds, November 1866.

TABLE No. 3.—(Referred to *supra* Question 10,063.)

STATISTICS of the RIVER AIRE and its TRIBUTARIES.

EXHIBITING the Area of Surface drained by the RIVER AIRE at several points of its course down to and including the Town of Leeds and its Suburbs; the Amount of Population residing on such Surface, and the Average Number of Individuals per Acre in the year 1861. Exhibiting also the same particulars as respects its Tributaries, the Bradford Beck, the Pudsey or Holbeck Beck, and the Addle Beck.

No. of District on the Map.	Description of District.	Area of each District in Acres.	Population of each District.		Total Area in Acres.	Total Population.		Remarks.
			Total No. of Persons.	Individuals per Acre.		Total No. of Persons.	Individuals per Acre.	
1	Skipton district, including Skipton and all places draining into the river above Skipton.	65,000	12,733	—	65,000	12,733	0·196	
2	District above Keighley, between Skipton and Keighley - -	27,500	10,893	—	92,500	23,626	0·255	
3	Bingley and Keighley district, including Keighley and Bingley, and all places draining into the river above the point where it receives the waters of the Bradford Beck.	39,700	44,877	—	132,200	68,503	0·518	
4	Bradford Beck district, including Bradford town - - -	13,100	126,184	9·655	145,300	194,917	1·342	Bradford Beck, immediately below Bradford town. 11,000 acres. 115,181 persons. 10·471 individuals per acre.
5	Kirkstall district, comprising all places which drain into the river between Bradford Beck and the west end of the town of Leeds.	25,000	64,398	—	170,300	259,385	1·523	
6	Holbeck Beck district, including Holbeck and part of the south ward of the town of Leeds.	16,000	74,037	4·627	186,300	333,422	1·790	This beck, before entering Holbeck, that is excluding Holbeck and South Ward, drains 15,600 acres, having a population of 52,850 persons, or 3·388 individuals per acre.
7	Part of the Township of Leeds on the south side of the river (700 acres) not drained by means of the Addle Beck, and lands on the south side of the river, between Leeds Bridge and the point opposite to which the Addle Beck enters the river (200 acres).	900	41,292	—	187,200	374,714	2·002	N.B.—This includes part of Hunslet.
8	District of the Addle Beck, including part of the town of Leeds -	9,500	87,520	9·213	196,700	462,234	2·350	Addle Beck, when it reaches Sheepscar Bridge, is the drain for 9,000 acres, having a population of 23,931 persons, or 2·659 individuals per acre, of whom two-thirds are within the township of Leeds.
9	Hunslet Beck District, below Leeds - - - - -	2,700	17,175	—	199,400	479,409	2·404	
	Total - - - - - -	199,400	479,409	2·404				

(Signed) J. W. LEATHER,
Leeds, November 1866.

BRADFORD.

Mr. J. W. Leather.

14 Nov. 1866.

TABLE No. 4.—(Referred to *supra* Question 10,096.)

STATISTICS of the CALDER VALLEY, exhibiting the Area of Surface drained by the River Calder at several Points from its Source above Todmorden down to its Confluence with the River Aire at Castleford; the Amount of Population residing on such Surface; and the Average Number of Inhabitants per Acre in 1851 and 1861; exhibiting also the same Particulars in respect of its Tributaries the Hebble Brook, which receives the Sewage of Halifax, and the River Colne, which receives the Sewage of Huddersfield.

Number of District on the Map.	Description of District.	Area of each District. Acres.	Population of each District in 1851.		Population of each District in 1861.		Total Area in Acres.	Total Population in 1851.		Total Population in 1861.	
			Persons.	Individuals per Acre.	Persons.	Individuals per Acre.		Total Persons.	Individuals per Acre.	Total Persons.	Individuals per Acre.
1	Upper (or Todmorden) District down to confluence of the Hebble Brook (from Halifax)	68,940	61,383	0·890	63,465	0·920	68,940	61,383	0·890	63,465	0·920
2	Hebble Brook (Halifax)	7,100	48,924	6·890	51,488	7·251	76,040	110,307	1·450	114,953	1·511
3	District between Hebble Brook and River Colne (Huddersfield)	20,000	36,463	1·823	40,097	2·005	96,040	146,770	1·528	155,050	1·614
4	River Colne to and including Huddersfield	44,800	86,013	1·919	93,100	2·078	140,840	232,783	1·652	248,150	1·761
4a	River Colne below Huddersfield	18,000	28,340	1·574	29,240	1·624	158,840	261,123	1·643	277,390	1·745
5	District from River Colne to pumping station of Wakefield waterworks near Stanley Ferry	82,610	117,148	1·418	141,316	1·710	241,450	378,271	1·566	418,706	1·734
6	District below Wakefield pumping station to confluence with the River Aire	12,400	9,719	0·783	14,211	1·147	253,850	387,990	1·528	432,917	1·705
	Total	253,850	387,990	1·528	432,917	1·705	—	—	—	—	—

TABLE No. 5.

TABLE showing the Falls of the several Weirs on the River Aire, from the King's Mill Weir at Leeds to the King's Mills Weir at Knottingley.

GREAT OR UPPER WEIR OF THE KING'S MILLS AT LEEDS.

	Feet.	Zero.	Fall of each weir Feet.
Highest flood at Leeds	·33	above	5·00
Crown of weir, or head level of Leeds old waterworks engine LEEDS.	5·00	below	4·20
Nether Mills weir	Deals 8·66 / Crown 9·20	below	4·38
Hunslet Mills weir	Deals 12·54 / Crown 13·58	below	4·08
Knostrop Mills weir	Deals 16·25 / Crown 17·66	below	4·42
Thwaites Mill weir	Deals 20·58 / Crown 22·08	below	5·92
Thorpe Mill weir	Deals 26·38 / Crown 28·00	below	12·63
Fleet Mills weir	Deals 38·14 / Crown 40·63	below	5·95
Methley weir	Deals 45·50 / Crown 46·58	below	5·97
Castleford weir	Deals 50·50 / Crown 52·55	below	7·20
Knottingley weir (King's Mills)	Deals 58·80 / Crown 59·75	—	—
			59·75

* The Great or upper weir of the King's Mills at Leeds is about 87½ feet above Ordnance Datum, or the mean level of the sea.

TABLE No. 6.

THE PRIVILEGE of the Soke or King's Mills at Leeds, enjoyed by Charter from Charles the First, was extinguished by the Act of Parliament, 2nd Vict. c. 17. [14th May 1839.]

13,000*l.* was agreed to be paid to the owner by four annual instalments.

Trustees were appointed, who (by s. 35) were empowered to levy a rate, called the "Soke Rate," not to exceed 3*s.* in the pound on all premises used or occupied as maltkilns, or malthouses, or common breweries, and upon all hotels, taverns, and licensed public-houses, &c., where the occupiers brew their own ale or beer.

1*s.* 3*d.* in the pound upon all other hotels, taverns, licensed public-houses, and beer-shops.

4½*d.* in the pound on all premises consisting of a dwelling house and shop, or warehouse connected together, and rated to the relief of the poor at 10*l.* or upwards.

6*d.* in the pound on all dwelling houses not connected with a shop or warehouse, and rated to the relief of the poor at 10*l.* or upwards.

Half the above to be paid by the owner and half by the occupier, and 1½*d.* in the pound on all other rateable property, to be wholly paid by the owner.

With a proviso that no hotel, tavern, or other licensed public-house should be assessed on a higher rental than 120*l.* per annum, though the same may be rated at a higher sum to the relief of the poor.

(Signed) J. W. LEATHER,
Leeds, November 1866.

Mr. S. Blamires.

Mr. SAMUEL BLAMIRES (Bradford) examined.

10,232. (*Chairman.*) You are a soap manufacturer?—Yes.

10,233. Where are your works situated?—In Sedgwick Street.

10,234. Near to Bradford beck?—No, some distance off.

10,235. What number of men do you employ?—Seven.

10,236. What weight of soap do you make per annum?—Rather over 500 tons.

10,237. (*Professor Way.*) Is it principally made from tallow?—Oil and tallow.

10,238. Is any resin used?—None whatever.

10,239. In making the soap do you make your own caustic alkali?—Yes.

10,240. What becomes of the lime which you use?—It is carted away for building brick kilns.

10,241. It is a cheaper sort of lime?—Yes.

10,242. It is used for sticking rough structures

together?—Yes, and for preventing bricks from burning as well.

10,243. When you are causticising your soda you have two products of deposit, namely, the lime which you speak of and the caustic soda?—It is all potash soap, soft soap.

10,244. Do you make it especially for the manufacturers of Bradford?—Entirely so.

10,245. Not for house consumption?—No, except that a few people may buy a small quantity; such as the neighbours.

10,246. It is principally for the woollen trade?—Entirely so.

10,247. Do you separate your soap after boiling?—No separation whatever takes place in soft soap.

10,248. It is boiled down in a much smaller quantity of water than ordinary soap?—It is necessary in making hard soap to separate the sweet principle, the glycerine, from the soap. In our case there is nothing of the sort; the sweet principle is contained in the soft soap, and consequently it gets the name of sweet soap.

10,249. You take a certain quantity of tallow and oil?—Yes.

10,250. Is the alkali which you use a strong solution?—Yes.

10,251. Does the water of that alkali all go into the soap?—Yes, all, except what is evaporated in the act of boiling.

10,252. You use as small a quantity of water as you can?—Yes.

10,253. And the whole product of the soap pan is soft soap?—Yes; there is no waste whatever.

10,254. You have nothing running from your pans?—Nothing whatever.

10,255. You run no liquid away?—No, we should fill the drains if we did.

10,256. Then, so far as your manufacture of soap is concerned, you are not a polluter of the river in any shape or form?—Not in the slightest degree.

10,257. (*Chairman.*) Do you know the state of the Bradford beck?—Yes, I know that it is in a very filthy state.

10,258. Have you formed any conclusions as to what ought to be done to purify it?—With regard to the sewage, I think that it is possible to pump the sewage from the outlet in dry seasons, not in flood time, into large tanks or cisterns, and by means of adding lime, that you might be able to cause a sediment to settle pretty quickly, and to allow the clear water to run away into the beck, though it would not be clean water; by that means you would utilize the refuse.

10,259. Do you think that it is necessary to deal with the rivers in some way, in order to prevent their further pollution?—I think that it is very desirable.

10,260. And to improve them, if possible?—Yes.

10,261. For the trade of the district?—For the trade of the district, and for the health of the town. In summer time the beck is very bad.

The witness withdrew.

Mr. Frederick William Anderton (Bradford) examined.

Mr. F. W. Anderton.

10,262. (*Chairman.*) You are a worsted spinner?—Yes.

10,263. Where are your works situated?—In Leeds Road.

10,264. Are they near the beck or near the canal?—They are within a quarter of a mile of the canal.

10,265. But they are not situated upon either?—No.

10,266. Have you a main sewer coming up to your works, or near your works?—Yes; there is a beck which runs from Bowling.

10,267. You are upon a branch of the beck?—Yes.

10,268. What number of hands do you employ?—About 800.

10,269. What weight of water do you deal with per annum?—We wash about 120 packs of wool a week.

10,270. What weight of soap do you use annually?—We use, I suppose, about 12 packs of solid soap per week.

10,271. And what quantity of oil?—We use oil merely for the purpose of lubricating the machinery.

10,272. You do not use it in the treatment of the fibre?—Yes; it is used in the process of combing.

10,273. Does any of it pass away with the soap water?—Yes, some of it is washed out.

10,274. Is your soap refuse treated so as to extract the oil and grease?—Yes, it is treated on our own premises, which we let to certain parties who conduct the work.

10,275. What are you paid for the material which they get out?—They pay us a certain sum, but we have to direct the application of steam.

10,276. What weight of material do they recover?—I am not aware, for it is entirely under their charge; we have power to interfere, but we do not interfere. They pay us according to the quantity of soap which we consume per week.

10,277. What is that proportion?—It is about 5*s.* on a pack of soap. We find steam and certain things, which brings down the cost.

10,278. It has not occurred to you to attempt to treat the soap refuse yourselves?—No; we think that they are better enabled to do it; they do it for other firms as well.

10,279. When they have treated the waste water, where does it go?—Into the beck which runs from Bowling, and which flows into the Bradford beck.

10,280. Have you noticed whether that water is very dirty, or is comparatively clear?—It is quite clear so far as the eye is concerned, but of course it is mixed with vitriol; they extract the grease from the soapsud with vitriol.

10,281. Have you waterclosets, or privies, for the people upon your premises?—We have both.

10,282. Where do the waterclosets empty?—Into the beck.

10,283. What do you do with the refuse which is collected in the privies?—We have 22 privies which flow into the beck, and four from which the refuse is carted away for manure.

10,284. Would it be very difficult for you to arrange that the refuse from all should be carted away?—No, if we could get people to take it away; but with the four privies which we have, there is the greatest difficulty in the world to get anybody to cart the refuse away.

10,285. But you could so arrange your privies that the produce might be carted away, if you could find a sale for it?—Possibly so, but it would have to be conveyed a little distance from the works.

10,286. Do you use engine power?—Yes.

10,287. What amount of power do you use on the works?—About 400 horse.

10,288. What weight of coal per annum do you use?—About 48 to 50 tons per week, or 2,600 tons per annum.

10,289. What becomes of the ashes?—They are carted away.

10,290. Have you to pay for their being carted away?—Sometimes we have; but now that building is going on, parties are glad to take them away.

10,291. You get rid of them without any difficulty?—Yes.

10,292. Are any of them at any time thrown into the beck?—No, not at all.

10,293. Do you pass any solids into the beck?—No, with the exception of the produce from the privies.

10,294. Do you use much water in your processes?

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—Yes; I should think that we use about 18,000 gallons per day.

10,295. Where do you get it from?—We pump it all from two wells.

10,296. What depth are they?—One is 80 yards, and the other is 50 yards.

10,297. What is the quality of the water?—It is very soft.

10,298. Is it alkaline?—There is magnesian lime in it.

10,299. That will not make soft water?—It is very soft in the boilers; there is a deposit as fine as powder.

10,300. Have you had any analysis of it?—I think not.

10,301. Do you take any water from the corporation?—No, except for the offices for washing hands and domestic purposes, and stables, and for similar purposes.

10,302. In what state in your opinion is Bradford beck?—I think that it is about as bad as it can be.

10,303. And Bradford canal?—It could not be worse, I should say.

10,304. In your opinion is it necessary that something should be done to improve the state of the beck, and the canal, if possible?—I decidedly think so; in fact, those who live anywhere near will have to remove from the town unless something is done, they cannot possibly continue to live there. I live within a quarter of a mile of the canal which flows in the valley, and during the summer months we are obliged to be away.

10,305. On account of the smell?—Yes.

10,306. Does it cause sickness to yourself or to any of your household?—It causes sickness to ourselves, and the gardener says, that he has frequently been sick upon the ground while gardening, and the servants in the house complain of it; in fact, the smell gets into our rooms; we have been obliged to go from the rooms facing the canal.

10,307. Did you join the other gentlemen in indicting the proprietors of that canal?—Yes; it was a matter of self defence. I may state that one night we had an escape of gas in one of the bed rooms, at about 12 o'clock at night. We opened the windows to let it out, and the stench from outside was so intolerable, that we shut down the windows, and preferred having the gas to having the stench from the canal.

10,308. (*Mr. Harrison.*) What wool do you use; is it British wool?—We use both English and foreign wool.

10,309. In what proportion?—I do not know; it varies with the trade; I can hardly tell.

10,310. Do you find a great deal of difference in the quantity of refuse from foreign wool as compared with British?—There are what are called white wools and greasy wools, and from the one the refuse is three times as great as from the other.

10,311. Is the quantity of soap which you require to use in the one case very different from that which you require in the other?—No, the greasy wools, as a rule, do not require so much soap as the white wools.

10,312. What wools do you call greasy?—Scotch wools we call greasy, Highland wools; those are unwashed wools.

10,313. Do they not generally wash Highland wool?—No.

10,314. (*Professor Way.*) You have said that you use 12 packs of soap per week?—Yes.

10,315. That would be about a ton and a half?—Yes.

10,316. Is that soft soap?—Yes.

10,317. What is the cost per pack?—78*s.* per pack.

10,318. Is soft soap necessary for you; cannot you deal with soda soap?—Soft soap is used for washing mercantile wools to a great extent.

10,319. The essential difference between soft soap and other soap is, that one contains soda and the other potash; is not that so?—It is the alkali which they mix with it which washes the wool.

10,320. Is not it exceedingly costly as compared with soda?—I do not think that soda would be sufficiently strong for our purpose; it would not be sufficiently searching for the wool.

10,321. Is there more of the alkaline in soft soap?—I should think so.

10,322. If you took ordinary soap and used caustic alkali, do you think that you would get the same result, or would you injure the wool?—One is very particular not to alter much in these matters, if you find a thing test well and not affect your spinning. As a rule you do not wish to use more than a certain quantity of alkali, otherwise you would injure the wool.

The witness withdrew.

Mr. W. B. Hamilton.

Mr. William B. Hamilton (Bradford) examined.

10,323. (*Chairman.*) You are engaged in grease manufacture?—I am.

10,324. You take soap washings from manufacturers and extract grease from them?—I do.

10,325. Where are your works situated?—In Canal Road.

10,326. What number of men do you employ?—Between 8 and 10.

10,327. What weight of grease do you get per week?—Between three and four tons a week.

10,328. Are you constantly employed?—Yes.

10,329. (*Professor Way.*) I suppose that there is no great difference in the mode of treating soapsuds?—No.

10,330. Do you treat them with sulphuric acid?—Yes.

10,331. Can you give an idea of the quantity which you use per thousand gallons of soapsuds?—No, I never measured the quantity of suds which each tank takes.

10,332. But still you do add a given amount of acid to a tank?—We use about half a carboy to a tank, which will contain about 20 tons of sud water.

10,333. That is half a carboy of brown acid?—It will be about 80 pounds of sulphuric acid.

10,334. Of brown acid?—Yes.

10,335. Is the water which you treat the whole of the soapsuds, or only the richest portion of them?—It is generally the richest portion of the soap suds. The solid matter is generally collected in sumpt holes, and farmers put it on the land for manure.

10,336. Do you take the whole of the soapsuds and the wash water to extract the soap, or only the first runnings?—I take the whole of them.

10,337. You have your works put up in the mill yard?—Yes.

10,338. And all the wash water goes into your tanks?—Yes.

10,339. You do not exercise any check upon the time when it passes or ceases to pass into your tank?—No.

10,340. It all goes through?—Yes.

10,341. In what state does the water go out after you have treated it?—Nearly bright.

10,342. Is it milky?—Sometimes it is and sometimes it is not.

10,343. Have you reason to believe that you get the whole of the grease out of it?—Yes, I generally take good care of that.

10,344. Have you ever ascertained the quantity of grease which is in it?—As nearly as I possibly can. For instance, in very windy weather there is very great difficulty in getting the tanks to settle, and that is the only difficulty which I have, but in calm weather we get all the solid out.

10,345. Were you present when Mr. Anderton gave his evidence?—Yes.

10,346. Did you hear him say that he uses 12 packs of soap per week?—Yes.

10,347. That is to say, a little less than a ton and a half of soft soap?—Yes.

10,348. And he receives 5*s.* per pack?—Yes.

10,349. Do you work Mr. Anderton's soapsuds?—No.

10,350. Is that the usual price?—Mr. Anderton has to find steam and other implements for the manufacture of the grease on his premises. I generally take all the soap water from the manufacturer, and find everything myself, and consequently I get the water a trifle cheaper.

10,351. The question is, what quantity of grease, is actually used and what quantity is recovered; would half of that ton and a half be grease?—No, the wool generally takes the greatest portion of the virtue out of the soap. I should say that about a quarter of the amount, or perhaps about 15 cwt. of grease, would be produced out of 12 packs of soap.

10,352. Would the soap, or the grease of the soap, remain in the wool?—No, simply the oil which they use in the manufacture of the soap.

10,353. Supposing that you wash wool, which is greasy, with soap, what is the result?—The grease goes along with the soap.

10,354. And it will be in the water?—Yes.

10,355. Then whatever quantity of grease has been used in the shape of soap, would be found in the soapsuds, even with an addition from the natural grease of the wool, would it not?—It would.

10,356. Then why is there this enormous discrepancy between the quantity recovered and the quantity used in the shape of soap?—A great portion of the grease comes out in the pressing in the shape of a cake, something like the pressing of oilcake, that is another refuse.

10,357. You cannot get out the whole of the grease?—No, it is pressed through canvass.

10,358. Is it not worth getting out?—No.

10,359. Is that burnt?—No, the farmers buy it. I sell it to manure manufacturers, and also to farmers themselves. I sell about 300 tons per annum. Some five years ago the whole of the suds used to go into the beck.

10,360. They find it very good for turnips?—They do.

10,361. So that it is not lost?—It is not lost.

10,362. Do you think that the grease recovered would pay for a better purification of the soapsuds than is now accomplished?—I do not.

10,363. You mean to say that at this moment as much money is spent upon it as can be?—Yes.

10,364. Do you not use bags in the presses?—Yes.

10,365. And those presses are heated with steam?—Yes.

10,366. Is it double case?—No, single case.

10,367. The steam actually goes into them?—Yes.

10,368. Do the canvass bags last long?—They last for from five to six months.

10,369. Are they used several times in a day?—Yes, they are used every day; in and out of the presses they are used all day long.

10,370. Is it the friction or the nature of the liquid which destroys them?—I should say that it is the constant doubling up; the steam, too, will rot them.

10,371. The liquid, of course, is acid?—There is a little acid in, but it is very trifling.

10,372. I may assume that you get as much service out of these soap suds as is to be obtained from them?—I do.

The witness withdrew.

Mr. Alfred Illingworth (Bradford) examined.

10,373. (*Chairman.*) You are a member of the firm of Daniel Illingworth and Sons, of Bradford?—Yes.

10,374. What manufacture do you carry on?—We are spinners.

10,375. Where are your works situated?—In Thornton Road.

10,376. Are you upon any branch or arm of any of the becks?—We do not avail ourselves in any way of them.

10,377. Are you near a branch of the beck?—No, we are at some distance from it. We do not depend upon it in any way for washing or condensing purposes.

10,378. What number of hands do you employ?—From 500 to 600.

10,379. What amount of engine power do you use?—A pair of 50-horse engines.

10,380. What weight of coal do you burn?—From 40 to 50 tons per week; it is variable.

10,381. What becomes of the ashes?—They are carried from the premises, and are disposed of for road making.

10,382. They do not go into the stream?—No, they are mixed to some extent with material.

10,383. Do you use much water upon your premises?—Yes.

10,384. What quantity of water do you use?—About 80,000 gallons a week.

10,385. Where do you obtain it?—From a run of water in the land, which we collect into reservoirs, and we use the condensed water from the engines. We have surface condensers.

10,386. Do you use any of the roof water from your premises?—It passes into the reservoir, but it passes through the engines, and we use it as distilled water.

10,387. Do you buy any water from the corporation?—Not for woolwashing, but for the waterclosets we do.

10,388. You have waterclosets upon the premises?—Yes.

10,389. Exclusively waterclosets?—Yes.

10,390. Where do the contents of the waterclosets go?—Into tanks.

10,391. What becomes of the refuse?—It is carried away upon the land.

10,392. You do not pass it into Bradford beck?—No.

10,393. Then you do not pollute the beck?—Not at all.

10,394. Do you dye at all?—No.

10,395. What weight of soap do you use per week?—About 10 packs per week, at present.

10,396. What becomes of your suds?—They are passed across to the premises of my relatives, where there is an establishment of Mr. Hamilton's, and they are treated by him.

10,397. Where does the refuse soap water go to?—Into the drain.

10,398. And ultimately into the Bradford beck?—Yes.

10,399. So that you pollute that beck, if there is any pollution in the water?—Yes.

10,400. What weight of wool do you treat?—About 100 packs a week.

10,401. Is there any refuse of any sort from the wool?—We have tanks outside the premises into which the soap water passes, and there is a solid deposit.

10,402. Is there any fibrous refuse?—None whatever; at least none which we can avoid.

10,403. Have you any idea about what proportion of the grease in the soap used is recovered from the soap suds?—We cannot tell that; we do not have it under our own management.

10,404. Do you know about what you are paid for the soap water?—Mr. Hamilton has it at a little under the ordinary price, in consequence of his finding his own apparatus.

10,405. That is the gentleman who preceded you in giving evidence?—Yes; he pays a little under 5*s.* in consequence of our having no further trouble with it.

10,406. (*Mr. Harrison.*) Have you ever had an opportunity of seeing the water as it passes away?—No; I do not happen to have noticed it at all.

10,407. (*Professor Way.*) What does your soap cost?—About 76*s.* a pack is the present price.

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10,408. And you use 10 packs a week?—Yes.

10,409. That is 760*s.*, or 38*l.* a week?—Yes.

10,410. And you get 5*s.* a pack for the grease?—Yes, a little under 5*s.*

10,411. That is 2*l.* 10*s.* out of 38*l.*?—Yes; it is, I think, about 7½ per cent.

10,412. (*Chairman.*) Is there anything further which you wish to state?—Our old premises were upon one of the polluted streams of the town, and one of the principal inconveniences which we suffered then was from chemicals in the water injuring our boilers.

10,413. I presume that you know the state in which Bradford beck is?—Yes.

10,414. And the streams and rivers in Yorkshire generally?—Yes, to a considerable extent.

10,415. In what state do you say that the beck is?—It is in a very bad state. So far as it is covered over within the town, the nuisance to the town is mitigated. There is one exposed place in Thornton Road, the drainage of which seems to be merely a pool, the run of water being so slight.

10,416. Do you think that it is necessary to take notice of the polluted state of the streams in the district?—I should think so, certainly, if there is a remedy.

10,417. For the purpose of trade itself?—Yes.

10,418. The same water being used by one manufacturer after another, it would be desirable, if possible, to limit the amount of pollution passed into the stream?—Yes, our town is so situated that we should want an increased volume of water to a very considerable extent, before anything could be done. The stream which ran past our old premises had from 15 to 20 mills upon it; in summer time the water was so hot that we could scarcely use it for condensing purposes; that was in the early morning, before the full stream was in.

10,419. (*Mr. Harrison.*) What wools do you use?—Both English and colonial.

10,420. Do you find any difference in the quantity of soap which you require?—Not to any appreciable extent. English wool varies, and so does colonial.

10,421. (*Professor Way.*) Something has been said about Highland wool. Do you know of your own knowledge whether there is more grease in the wool of mountain sheep than in other wool; does nature provide a sheep with more grease in the wool in a cold district?—Yes, but more is put on by the farmer for protection.

10,422. Nature does not do it?—No.

10,423. Have you heard of the plan of obtaining potash from wool?—Yes.

10,424. Did it strike you as a novelty when you first heard of it?—It is done in France. I do not know that it is done in the neighbourhood of Bradford.

10,425. Are you conversant with that process?—No. Messrs. Isaac Holden and Sons have a wool-combing establishment in France, where it is carried out.

10,426. (*Chairman.*) And where it is carried out so as to pay?—Yes, on some classes of wools; greasy wools.

10,427. (*Professor Way.*) It pays three per cent. upon the weight of the wool?—Yes.

10,428. (*Chairman.*) Do you know what that wool is?—It is greasy French wool.

10,429. (*Professor Way.*) Is that a secretion of the animal's system; is it natural?—It is unquestionably natural.

10,430. (*Chairman.*) Is there any place in England that you know of where that potash is recovered?—Not that I am aware of, but there may be.

10,431. Are you aware of any reason why it should not be recovered in England?—No, excepting that in the worsted districts a much smaller portion of that description of wool is used than in France.

10,432. (*Professor Way.*) Such a quantity of potash is not common to all wool?—Certainly not.

10,433. Then if it is peculiar to some kind of wool, does not that point out some accidental circumstance?—There is naturally a considerable amount of potash in all wool, but most of the wool which comes to these countries is washed; that is the case with the colonial wool.

10,434. Then the potash has been taken out before the wool comes to you?—Yes.

The witness withdrew

Adjourned to to-morrow at 10 o'clock.

Bradford, Thursday, 15th November 1866.

PRESENT:

ROBERT RAWLINSON, ESQ., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, ESQ. | Professor JOHN THOMAS WAY.

HENRY WILLIAM RIPLEY, ESQ. (Bradford), examined.

H. W. Ripley, Esq.

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10,435. (*Chairman.*) Are you president of the Chamber of Commerce for this district?—Yes.

10,436. You are engaged in the Bradford trade?—Yes.

10,437. In what department of that trade?—I am a stuff-dyer, that is my principal business here.

10,438. You have, I believe, connexion with some other department also?—Yes, I have connexion with other branches of the trade.

10,439. How long have you resided near Bradford?—I was born in the borough.

10,440. You remember Bradford and the neighbourhood since your boyhood, do you?—Yes.

10,441. And you remember the state of the becks and the river at that time?—Yes, I remember the state of the becks certainly.

10,442. Have you prepared any details as to the growth of the local trade of Bradford and the growth of the population?—No, I have not attempted to give any actual figures or details, but I can give some general information.

10,443. Do you know how many Chambers of Commerce there are in Great Britain?—Between 30 and 40 I believe.

10,444. Are they all in communication with each, other?—The greater number of them are. Nearly 30 are in communication with each other.

10,445. You are self-constituted and independent bodies in your own localities?—Yes, but conferring together generally on subjects which are for a common purpose.

10,446. What are supposed to be the duties of your Chamber of Commerce?—Primarily it has to attend to the interests of the district, to communicate with Government on any matters that may affect the trade generally having reference to our foreign arrangements, and to negociate with foreign countries through our own Government for the alterations of tariffs where they unfortunately exist.

10,447. In the event of legislation being necessary for prevention of pollution of rivers, would that, in your opinion, be a fit subject for the intervention of your Chamber of Commerce, for instance, to consider any proposed Act of Parliament?—I think it would be a very proper question to be submitted for the consideration of the Chamber of Commerce.

10,448. You have not only to compete with the home trade, but you are necessarily brought into competition with foreign trade?—From time to time we are very closely indeed.

10,449. I suppose that, communication with foreign countries being so swift and rapid, any serious interference with the English trade might place you at a disadvantage with foreigners?—As a matter of fact this particular district has lost a great part of one branch of trade in consequence of the close competition with France, but fortunately other branches of trade have sprung up, so that we have not felt it so much as would otherwise have been the case.

10,450. Would you say that in legislating for prevention of pollution of rivers, great consideration should be given to the probable cost that would be thrown upon the English manufacturers?—I think the whole question should have the most careful consideration. While, on the one hand, it is important to prevent pollution, on the other hand the greatest care should be taken not to theorize merely as to the course which is to be adopted for the prevention of that pollution, otherwise what might appear a little matter to parties not engaged in trade might be very serious to the parties themselves, and, in point of fact, it might have the effect of either removing trade from a particular district or from the country, competition being so close in many branches of business.

10,451. Is it within your cognizance, as president of your own chamber of commerce, what would be the gross sum dealt with in trade in your district?—It is a very difficult thing to give even an approximate estimate of the actual value of the trade of the worsted district for instance, and by the worsted district I mean not merely Bradford, but Halifax, Keighley, Bingley, and the whole of the surrounding neighbourhood where the worsted trade is carried on in contradistinction to the woollen trade which exists at Leeds, Huddersfield, Dewsbury, and Batley. It is impossible to separate the trade of Bradford from the trade of Halifax and adjoining places.

10,452. Suppose you take the woollen trade of Yorkshire, can you give us within half a million the sums that are involved in the woollen manufactures?—I should prefer confining my estimate to the worsted trade, leaving the woollen trade out. I do not think I have any data as to the woollen district. Having a pretty intimate knowledge of the capacity of the various dyeing and finishing establishments in the district, I have calculated the quantity of pieces which each is capable of dyeing and finishing and that gives, I believe, very tolerably correct data on which to base the quantity of goods that pass through the merchants' hands, and the amount at which I so arrive is between 6,000,000 and 7,000,000 pieces of goods annually. The average value of those pieces will I take to be, about 50*s*.

10,453. What would the length of the pieces be?—They vary very much in length, from 28 yards to 60 or 70 yards. The great majority of them are of an average length of about 50 yards.

10,454. What is the weight?—The weights vary very much indeed also; but the average weight of the great majority will be from 6 lb. to 7 lb.

10,455. (*Mr. Harrison.*) A good deal of stuff is sent to Leeds to be dyed, is there not?—Yes. Taking 6,000,000 to 7,000,000 as the basis, the entire value of those goods would be from 17,000,000*l*. to 18,000,000*l*. Then we have an export trade in yarn, amounting to between 5,000,000*l*. and 6,000,000*l*. Then we have a trade to Scotland, to Norwich, Manchester, and on a small scale to other parts of the kingdom amounting possibly to 3,000,000*l*. I think I have correct data for making, in round numbers, the value of the trade of the district, of the textile worsted trade, to be about 24,000,000*l*. or 25,000,000*l*. per annum.

10,456. (*Chairman.*) I assume that in all cases where that trade is carried on water is used to a large extent, and a considerable amount of pollution arises from the trade at present?—Water is used in large quantities by the manufacturers. It is used for two operations, to scour the wool and for condensing purposes in the engines. In the one case the water is fouled, and in the other it is merely heated and passed away.

10,457. The question of rivers pollution is intimately connected, is it not, with the expenditure of that vast mass of money annually?—Yes, especially in connexion with the dyers of the district.

10,458. If those annual sums were capitalized what would be the sum?—500,000,000*l*. at five per cent.

10,459. Is there land in Yorkshire worth 500,000,000*l*. including all the rivers?—If I had the money I do not think I should like to give it for all the land in Yorkshire. The interests at stake are of startling magnitude, when you look at the question from that point of view.

10,460. The interest engaged in trade are of that magnitude that you think too great attention cannot be given to them?—Yes.

10,461. It is a question that requires handling with the greatest care?—Yes. I believe you would find the greatest willingness on the part of persons engaged in trade generally to listen to every suggestion that might be made, and to do all that was in their power to remove nuisances, but if the time should come when they are interfered with in a way that they think injurious to themselves, you will find them rising as one man to protest against the ruin which would be brought upon them.

10,462. Is it your opinion, considering how large the interests are now and how enormous the capital is represented to be, that the business is a growing one?—It is a very rapidly growing business. It may appear from one point of view, looking at the statistics of the Bradford trade, in the decennial period from 1851 to 1861, that there was no large growth in the trade, but no greater mistake can be committed. During that time a transition was taking place in two processes of manufacture. Wool-combing, which had been before that period principally carried on by hand, was during that time, and since, changed to a process of machinery whereby, speaking roundly, six or eight men now do the work of at least 100. By that means during those 10 years the labour of many thousand hands was saved; during the same period the power-loom also was rapidly undergoing improvement, and those two causes made the district appear almost to have a stationary population, whereas in point of fact the trade of the district, I have no doubt, nearly doubled itself.

10,463. That is in value?—Yes. I have no doubt now we are growing in population in consequence of those causes which existed in the period between 1851 and 1861 having ceased to exist, that is, machinery has come to a comparative state of perfection. I believe that we are now growing in population very rapidly, indeed almost unprecedentedly. The increase in the export of yarns between 1849 and the last Board of Trade returns is from 1,500,000*l*. to 5,500,000*l*.

10,464. May we take it that this trade has concentrated itself in Yorkshire partly in consequence of the water, and partly in consequence of the facility for obtaining coal?—It cannot have concentrated itself in Bradford in consequence of the water. It probably has concentrated itself in Bradford from two causes—one is, the cheapness of fuel, and the other is the superior energy of its inhabitants during the last 40 or 50 years; then the worsted trade was located principally at Wakefield and at Leeds. Wakefield appeared at that time as if it was to be the seat of the worsted manufacture, but the trade transferred itself here at a time when we really had no very large supplies of water, except what we obtained at some considerable cost from underground sinkings and borings.

10,465. You are the principal stuff dyers?—Yes.

10,466. You are, I believe, the owner of a number of mills?—Yes, I am.

10,467. What number of hands do you employ?—Between 500 and 600; they are principally men.

10,468. What amount of material do you get through in a year in pieces?—In number between 700,000 and 800,000. The average weight is about 8½ lbs. I may state that the goods which pass through our hands are of a class somewhat better than those which pass through many other dyers' hands, and our average weight is higher, I have no doubt, on that account.

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10,469. You carry on, I suppose, about one-tenth of the whole business?—Quite, and perhaps rather more.

10,470. What number of pieces do you dye?—About 500,000 of the 800,000 are dyed, and between 200,000 and 300,000 are finished.

10,471. What is done with the refuse from the dye vats?—The refuse from the dye vats is passed in our case into subsiding tanks or ponds in order to separate the solid matter from the liquid. Having a number of mills of my own, and there being also a number of mills lower down on the Bowling beck, which are sometimes short of water, I have made arrangements to supply them with water for condensing purposes by means of pipes laid along the railway. Our works are situated on Bowling beck, a mile from the centre of the town. On the course of that beck mills have been erected from time to time during the last 30 years, without any means whatever for a water supply, and for many months in the year, as the Bowling beck above our works in a dry season for months continuously is only an imaginary stream there is no water whatever. When there is any water we have reservoirs in which we have always, in my recollection, intercepted the water and used it at our own works; but the whole quantity of that water for many months is so small that the mills below have really a very precarious source of supply. That led to litigation some years ago between the mill owners, and ultimately I agreed to construct subsiding dams to separate the solid matter from the dye water, and then to pass the water down to those mills; they used it for condensing purposes, and then passed it again into the beck. Our source of water supply at our own works is twofold. We pump from some old colliery workings, which extend under many hundred acres in that district, from 1,000,000 to 1,200,000 gallons a day of hard water, which contains a large quantity of sulphate and carbonate of lime, but it is very good water for washing and many dyeing purposes. We also pump from the flagstone, which underlies the coal 50 or 60 yards, constantly about 600,000 gallons a day of pure soft water, which is perfectly free from any hardness whatever. That water is used in our own works for scouring purposes. Then by a system of pipes I supply a considerable number of mills with water for scouring their wool, the water being softer than any other that they can get, and I also supply a large number of dwelling houses. Half a million of gallons of pure soft water are used daily in that way; the mills down the stream are supplied from those subsiding dams before named with water; it answers their purpose for the boilers better than the natural water of the stream. The combinations which take place in our dyeing processes make the water in such a state that it keeps the boilers free from incrustation, which is not the case with the water in its ordinary state; and the millowners are thankful to have this water as we send it to them. With regard to the refuse, these subsiding dams have been made to a certain extent for my own convenience as well as for the convenience of the other mills, and I consult my own convenience in discharging the refuse. Generally the contents of one subsiding tank are discharged into the stream on a Saturday afternoon when the mills are standing.

10,472. In pumping this water you have a pretty fair chance of ascertaining whether it varies in volume at any particular time of the year, or from year to year. Do you find any variation in it?—The water from the old colliery workings varies very much in quantity according to whether it is a wet or a dry season; but the area is so large from which we pump, that even in the driest season which I ever knew (the summer before last), when we pumped the water down so that we could get into the old colliery workings, still we had sufficient.

10,473. You lower the head of the water, but do not exhaust the source?—There is a kind of underground reservoir; we exhausted it last summer; we pumped it nearly dry; we were nearer aground for a few weeks during the summer of 1865 than ever before. As to the soft water which comes from the flagstone, which underlies the coal about 60 yards, that is always sufficient in quantity to supply our pumps even night and day, but the level of the water in the pumping apparatus will lower very materially as between one season of the year and another.

10,474. How much does it lower?—Fifteen or 20 feet I should say.

10,475. At what time of the year will it be the lowest?—In ordinary seasons, it will be the lowest in November and December after the summer has passed, and previous to the rains, from which this supply comes by some unknown underground channels.

10,476. When does it get to its maximum?—By about March or February, and so it will remain to May or June without material variation in the level.

10,477. What ingredients do you use in dyeing that would have a softening effect upon water?—I do not say a softening effect, but a qualifying effect; there are a great variety of ingredients; the great consumption is in dyewoods, logwood, peachwood, etc.

10,478. Are there any acids?—Yes, we use large quantities of acids, and mordants, in working dye wares generally.

10,479. The acid diluted as it is in the water is found to have a beneficial effect on boilers?—Yes, the acid becomes neutralized I apprehend in its passage through the various operations; in fact the acid is not used in its natural state. Nitric acid is first made into nitrate of tin; muriatic acid is made into muriate of iron, etc. If you examine steam boilers that have had this water in them for many years you will find that they are cleaner now than they were previously; naturally there is a certain amount of sediment from the water containing large quantities of lime which adheres to the boiler, and is very difficult to get rid of.

10,480. Do you supply any of that water, or is any used for locomotive purposes?—I did supply the Lancashire and Yorkshire Railway for several years with it. We tried experiments with water from the subsiding dams for their locomotives occasionally, but the tubes of all the locomotives were found to be so fouled with incrustations of lime from, perhaps, the bad water which had been used before that the result was not satisfactory; but I never had the thing fairly tested.

10,481. They were not new boilers with clean tubes?—No. There is always a small amount of sediment in our dye-water from the subsiding dams, which is used by the mills below. It would be necessary to pass it through some filter in order to separate that sediment.

10,482. In managing your works what arrangements have you made for the soil of the workpeople; have you waterclosets or privies?—At all the mills and weaving sheds I have adopted, with the exception of one that was built 20 years ago, a system of waterclosets.

10,483. Where do they empty their contents?—The stench from privies in ordinary mills was so excessively offensive that in commencing to build some mills 10 or 12 years ago I adopted a fresh system, and I put in then, and have done so since, waterclosets, or rather long troughs. They are filled with water by a ball tap to within four inches of their height, and all the deposits are made into them during the day, and a man goes round at night, draws the valve, and the whole flushes out instantly down a pipe into a subsiding tank in the yard of each of those premises. There is no outlet except at the very top of this tank by means of a drain pipe, which is covered with a fine grating, and the result is that the great mass of solid excrements is retained in the tank, but the liquid passes away into the watercourse beck or stream.

10,484. You do not utilize it for agricultural purposes?—Yes, from time to time. I have tenants who sell it if they can. They say that they have to pay something for it to be taken away for agricultural purposes. I believe it to be a valuable manure.

10,485. Have you seen any of the new earth closets?—I have seen drawings of them.

10,486. Do you ever go to Wakefield?—Yes, occasionally.

10,487. I understand that they are going to try the experiment in the basement storey of the prison there?—The tank I use produces no nuisance of any kind in the neighbourhood where it is used. You are not conscious of its being there. At intervals of two or three months the solid is taken out, and the tank is emptied. As a question of nuisance, I am convinced that my plan cannot be improved upon, but on the question of utility I cannot speak.

10,488. It is a much cleaner and better process than the other, the cesspit and midden process, is it not?—Yes. They were perfectly horrid before. I am going to build about 300 cottages, and I am so satisfied with my plans that I shall adopt the same principle in all of them I do not like to see cottages with nasty privies about them. I am putting a watercloset in each, and shall have an intercepting tank to carry out the same idea.

10,489. Do any of the other manufacturers in this district adopt subsiding dams for their dye refuse?—No, I think not.

10,490. Are the results to you so satisfactory that you think you could recommend other persons to adopt the same means if they had the opportunity?—If they could utilize the water, or if they had any object in it, I think it is desirable that they should do so. In adopting these subsiding tanks, or ponds, my idea was that the water would take a considerable length of time in depositing all the solid refuse, and on that account I built at once three tanks, two of them being 120 feet long by 50 or 60 feet wide, and the other 120 feet long by about 40 or 45 feet wide; but in practice the deposit in the small tank of about 120 feet long by 40 feet wide, with a varying depth of from about seven or eight feet to nine or ten feet, is so rapid that the great mass of solid matter is deposited in the first tank. I am now using the other two ponds or dams as supply reservoirs for the mills, and the first-named answers the purpose for deposit. At present it is not only not an expense but an actual benefit, because it supplies the mills below with water. If the dyers had to collect the refuse and dye wares which deposit so rapidly in one of those tanks, a very serious question would arise. What are they to do with it?

10,491. If the prevention of pollution were made imperative, might not a number of the dyers be combined, and be required to pass the refuse water into one common outlet, so that it might be treated in one settling pond?—I think that is quite impossible. Dyeworks generally are so far from each other, and their interests are so different, that disputes would arise if they had subsiding tanks in common. The size of the tank that would be required for very large works for merely depositing the refuse would not in any case be a very serious objection, I think.

10,492. (*Professor Way.*) Do you use those tanks alternately?—No; the deposit is so rapid in the tank I mentioned, and it can be flushed into the beck during a half-holiday. Last night I ordered the contents to be slowly let out in order that you might see the state of the collection that has taken place since last Saturday week, the quantity and quality of the sediment. If instead of passing this refuse into the beck or watercourse, the sediment was taken out, it would be imperative then to have two of these tanks to be used alternately. Then the question would arise, having this immense mass of material collecting, what is to be done with it?

10,493. Do you think, that if you were compelled to empty the tanks by hand, and not to pass the contents into the beck, liming or any other process could make the refuse useful as a manure?—From time to time, for the last 12 or 15 years, I have mixed it with lime, and I have mixed it with nightsoil, and applied it to grass land—to arable land, but always with one result; the land becomes for several years perfectly barren, you could not get a crop off it.

10,494. It proved in practice to be injurious?—It proved to be so injurious that I am quite sure, from a long course of experience with reference to the refuse from dyeworks, it is not feasible to apply it to land advantageously for any agricultural purposes.

10,495. Supposing you were still compelled to dispose of the refuse without passing it into the river, and to make what is called a spoil bank of it, what area of ground would you have covered, do you think, at your works in the course of 10 years?—We have done that also for two or three years; large quantities of our dye wares now are not put into vessels to dye the goods, but the colouring matter is extracted in closed iron or copper vessels, and of course, this has to be taken out under any circumstances, it does not pass away; and for two or three years this refuse, amounting to many hundreds of tons, was put in to one solid heap in the vain hope of its rotting. For a period extending over four or five or six or seven years, I do not think any addition has been made to that heap. During this last summer we dug into it, and found it in the same state in which it was originally heaped up; that is, the spent wood.

10,496. (*Mr. Harrison.*) That is not the deposit in the tank?—No; but it is the same description of material. One of our people suggested that it might be possible to burn it, and they lighted fires in this heap some months ago, and the result is, that the heap has been almost burned down; half a dozen carts would carry the whole away. I could burn the refuse without very great inconvenience, but it would be a more difficult operation in connexion with many premises that are more closely surrounded with other buildings. The most feasible mode of getting rid of the refuse in my opinion is to burn it.

10,497. (*Chairman.*) Other parties would have to cart the refuse to some place where it could be so disposed of?—Yes; it might be done in that way.

10,498. You say that you would burn it. I suppose you are aware that ordinary clay can be burned by mixing small coal and refuse with it, which is used as ballast for railways in place of gravel?—Yes. I have seen that done frequently.

10,499. If this refuse is useless for agricultural purposes, there is still that mode of getting rid of it?—Yes; we had got so large a heap that we were afraid to continue to heap it up, but now that we have got rid of it we shall commence again to collect another heap and burn it in the same way.

10,500. Are you aware that at Huddersfield they burn the spent wood to a great extent under the boilers?—Yes; but that can only be the case where they use chipped wood. Stuff dyers generally use rasped wood, which is more economical, where it can be used. Chipped wood in limited quantities can be used under boilers.

10,501. (*Professor Way.*) I suppose that its indestructible quality is greater when rasped than in the natural form, as is the case with sawdust?—Yes.

10,502. Because all the juices are taken out in the treatment of it, and you have nothing but the woody fibre?—Yes. In addition to that, you have a combination of a stringent matter and sumach, and so on; the refuse is all but indestructible except by fire; it is valueless, and worse than that as a manure.

10,503. What you get in the subsiding tank is a totally different thing, is it not?—No.

10,504. The stuff which is precipitated from the dye water is the same kind of stuff as is fixed in the cloth which is dyed, is it not?—The greater mass is precisely similar to the material of which I have been speaking, the solid material.

10,505. It is not produced by the mixture of the different liquids?—No; it remains in solution to a considerable extent in the water which passes out from the deposited matter.

10,506. When dye water is allowed to rest, does it not subside into a precipitate with a tolerably clear liquid?—Never; we have tried ours, and we have never seen it so subside.

10,507. It cannot be filtered, can it?—Yes, of course, theoretically it can be, but practically I fear it

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cannot. A bed of ashes will filter the foulest dye water into perfectly clear water, so that you might almost drink it, but a bed of ashes becomes fouled very soon. It is impracticable to carry that system out.

10,508. The great difficulty in dealing with subsided matter in those tanks is that it is in a state of slush, and you cannot dry it?—The moment you begin to deal with large masses, the labour is so very costly that it becomes a very serious matter.

10,509. After all the quantity of solid matter is small as compared with the quantity of liquid that remains mixed with it after it has subsided, and it is very wet?—Yes, it is.

10,510. That would constitute your greatest difficulty, would it not?—In wheeling the stuff from subsiding tanks, of course, the water would drain out to some extent.

10,511. The quantity, which might not be large if it was dry, is very large in a state of sludge?—Yes; but it is not in that state two or three days afterwards. After the tank has been emptied it will not be in an actual state of sludge, it will be material that can be cut with a spade.

10,512. But in that state it contains large quantities of water?—Yes.

10,513. (*Chairman.*) What weight of coals do you use per annum?—About 20,000 tons.

10,514. What weight of ashes does that quantity yield?—That varies very much according to the decription of coal used. Lowmoor coal makes a very much smaller quantity of ashes than coal which comes from between this place and Wakefield. I should say from 15 to 20 cartloads a day.

10,515. What weight would a cartload represent, one ton?—Not so much as a ton of ashes.

10,516. What do you do with your ashes?—The Lancashire and Yorkshire Railway is contiguous to our works, and also there is a branch into our works from the Great Northern Railway, and these two companies are thankful to take all our ashes for ballast.

10,517. Do you tip any of the ashes into the river?—Not now. So long as I can recollect the Bowling beck, which in the winter becomes a large stream, they were wheeled principally all along the side of the watercourse.

10,518. That is parallel with it?—Yes; and when the floods came in winter the ashes were all washed away, but it was many years ago that the ashes were so dealt with.

10,519. Looking at the enormous weight of coal used in Yorkshire, and the enormous weight of ashes resulting from it, should you say that it would be advisable that they should be kept out of the stream?—By all means; it is perfectly monstrous now-a-days that any ashes should be put into the watercourses.

10,520. Are you aware whether it is the practice in certain parts to throw ashes into the streams?—No, I think not.

10,521. Is it not he case in Bradford?—No, I think not.

10,522. Would you be surprised to learn that upon every one of the streams that flow into the Aire and Calder there are thousands of tons of ashes per annum thrown in?—I can conceive that in some outside country places they do as our people did at Bowling 30 or 40 years ago.

10,523. Do you think it would be a legitimate interference on the part of the State with trade if they said that it should not be done?—I think there would be no difference of opinion on that question.

10,524. With regard to the pollution of the river by sediment from reservoirs or tanks, at present you put your sediment in, and it is not complained of?—We put it in as a matter of right, in point of fact we claim a right to put it in.

10,525. Would you like to be interfered with in that matter?—I have no objection to the whole question being very carefully discussed and considered, and if any feasible mode, which shall apply generally, can be brought to bear, and I think to some extent it might be, we should be glad to co-operate. I have given you strong proof of my willingness to co-operate. The 200 or 300 tons of refuse dyewoods which I produce in a year, I shall, now that I am satisfied that it is feasible, for the future not pass any into the stream, but burn it without material cost.

10,526. Have you tried what effect the ashes resulting from the burnings would have upon agriculture?—No; it is only recently that I ordered them to be collected in a few casks and let me have them at my farm, but whether that has been done I do not know.

10,527. It may turn out that although the solid material is not useful the ashes may be?—Yes, to a certain extent, I have no doubt they may be for manure.

10,528. Are you aware that generally throughout Yorkshire the sediment from the lodges attached to each mill is flushed out into the river, and passed from one mill to the other from Saturday night to Sunday night?—No, I am not aware of that.

10,529. Supposing there are 50 mills upon a stream in a course of 50 miles, each having a dam, does not this occur, that the one highest up first flushes his lodge into the stream, the next below him receives the mud so sent down, and he has no remedy but to flush it out in like manner. The next man gets the combined result of the two, and so it goes on down the stream. At last the flat reaches of the river become shallow, and the Navigation Company have to dredge out the deposit, or it so shoals that the river floods the adjacent land; whereas if the sediment were taken out by each manufacturer it would be a minimum to him, he would free himself and not injure his neighbour below him; he would also be free from the mud of his neighbour above him. But at the present time is not the state of things what I have described?—Yes, but a serious question arises there: how, except by flushing, is he to get it out without stopping his works?

10,530. He can easily get it out. Nothing is easier than to dredge it out upon a similar principle to the dredging operations upon the river below. It can be dredged out in the same way?—Theoretically it looks so, but I am not so sure that it is so practicable. In the first place a man wants his water clean, and you would stop his works as it appears to me.

10,531. But the sludge goes in and deposits itself in the first quiet place, and the accumulation of mud for one day will render the water unfit to use perhaps for a month for everbody below?—Yes, that I can quite conceive.

10,532. Do not you think that, if practicable, some means should be provided to remedy that state of things?—Yes, if practicable.

10,533. And that each person should contribute a certain amount towards preventing it?—That involves the whole question. After careful investigation as to what is desirable to be done, it appears to me that the circumstances elsewhere are somewhat different from the circumstances that exist here generally on our streams, because we are so limited in the supply of water.

10,534. (*Professor Way.*) You use the streams rather as a means of getting rid of the refuse water when you have done with it than as a supply, do you not?—We should be glad to use the streams of clean water if we could obtain access to them, but we are so far from them.

10,535. The view you would take would be different if you were dependent upon the refuse water for your supply as well as for your easement; take, for instance, the mills that are upon the river Calder, where they have to use the river water for the purposes of their trade, and where they also use the river as an easement for their works?—I think that every practicable means should be used, not only here, where the streams flow into the river, but also on the rivers themselves, to keep out as much pollution as is feasible, consistently with not trammelling the manufacturers to a degree that might be prejudicial.

10,536. The view which the Chairman was bringing before you was this, that you do incur a very large expense each time that you clear out what you have thrown in, that you make the river impure, and have

to deal with it afterwards as well as you can ?—You mean the country has to do so.

10,537. Upon the whole manufacturers are doing over and over again what each might once do individually, that is the result ?—Yes; but it appears to me that the difficulty is to show them a way of dealing with the refuse they get out, that is, I think, as difficult a question as clearing it out. I think that many manufacturers, dyers, and others, would not half so much object to getting the refuse out of the stream as to dealing with it when they get it out, it being in such large masses, what are they to do with it ? I think that that is the more difficult question of the two.

10,538. (*Chairman.*) Would not the answer to that be exactly the same as it must be in the case of ashes; there are gentlemen in Yorkshire who pour in ashes from 2,000 or 3,000 tons of coal per annum, and never take a spadeful away, and they will turn round with the same objection, and say, We cannot take the ashes away without costing us money; show us how we can do it, for that is no part of our business ?—The case is not exactly parallel, for it appears that ashes are thrown into the stream in some country places.

10,539. In Huddersfield by the County Bridge there are two mills, where you may see in a dry season ash-heaps projecting over to the opposite bank, waiting for the first flood to take them away ?—With regard to the ashes in this neighbourhood, there is often a considerable demand for them during the last summer, and occasionally in years past, they have been fetched from the manufactories by parties who begged for them.

10,540. Not only are streams obstructed by ashes, but if any riparian owner is excavating foundations or making a new road across his land, and the river is the readiest tipping place, the solids go in ; and from the highways bordering the rivers the surveyor has the mud scraped off, and the readiest place being the river, in go the scrapings ?—Yes.

10,541. Do you think it is a proper reply to make that that is the cheapest method of getting rid of the refuse ?—Not in itself.

10,542. (*Professor Way.*) Somebody or other has to dig out those ashes afterwards ?—Not always, I apprehend.

10,543. (*Chairman.*) The consequence is this, that the beds of those streams are, by the manufacturers, own confession, rising year by year, and the floors of their mills, which were before dry, are now flooded to the serious damage of the manufacturers ; the mills that had a certain water power are impeded, because the tail water cannot flow away, and all these people are suffering from their own misdeeds, none of them have the means of remedy, they cannot interfere with the river to improve it, but they can all do something to make it worse ?—All that is not a sufficient reason, in my opinion, for interfering with the large manufacturing interests of this country. Those mills which exist on the sides of the streams, and which are worked by water power, are comparatively of a very subordinate character as compared with the great mass which are worked by steam power. If that was the only injury that occurred I should say, leave things as they are; your remedy would, on the whole, be worse than the evil.

10,544. You would let them fill the river up ?—I should not have any apprehension as to the water-courses being continued in the same way ; water will always make a way for itself. The damage to those water mills, I should say, would be so immaterial that it would not be desirable to interfere with the large manufacturing interests of the country. I look at it from a much broader point of view ; there is the question of health to be considered. Our rivers, no doubt, are becoming so polluted, and the stench is so bad from many of them from time to time in the summer months, that it is imperative that something should be done to get rid of the nuisance to a certain extent at any rate.

10,545. (*Mr. Harrison.*) You stated just now that you use about 200 or 300 tons of dyewoods ?—There will be 700 or 800 tons, probably nearly 1,000 tons of material which is insoluble.

10,546. You mean 1,000 tons per annum ?—Yes, of material that would float away, or which in substance would pass along with the water. Then there may be possibly 500 or 600 tons more of other materials consisting merely of colouring matter and acids.

10,547. That is the quantity you use, dyeing upwards of one-tenth of the whole of the stuff goods of this district ?—Yes, I think so.

10,548. So that 10 times the 700 tons, or 7,000 tons a year would be the utmost quantity ?—Ten times the 1,000 tons.

10,549. That is 10,000 tons is at present the largest quantity of insoluble materials to be dealt with ?—Yes, so far as piece-dyeing is concerned.

10,550. Can you furnish us with any data as to wool-dyeing ?—It is very difficult to give particulars as to that. There is nothing like the same amount of material used for cotton warp and wool-dyeing in the district as there is of material used for piece-dyeing.

10,551. How much less would it be ?—It is mere guess, but you may take the one at 10,000 tons and the other at 5,000 or 6,000 tons.

10,552. The two together would be 15,000 tons a year ?—Yes, from that to 20,000 tons would represent the whole of the solid material from the dyeworks of the district.

10,553. Does that quantity bear any comparison with the weight of ashes that are removed from the manufactories ?—No ; the weight of ashes that are removed is very much larger than that, no doubt.

10,554. If I understood you rightly you stated that dyers would not object so much to separating the solid matter from the liquid as to being obliged to remove it ?—I think that that is the greater difficulty of the two. You can scarcely compare the two cases ; as to the ashes there is generally a use for them, they are used in various ways, for instance, to repair the roads and for making footpaths, and now they are very largely used to mix with mortar. There is no such purpose to which dyeware refuse can be applied. You have really to get the refuse away to some place where it can be permanently thrown aside.

10,555. If you had to pay for the removal of the 1,000 tons of spent dyewoods and refuse that you make in a year what would the expenditure be likely to be per ton ?—You have to obtain a piece of ground to place them on. These things become very large heaps. I cannot venture an opinion as to the question.

10,556. At Wakefield we found that they are put to the expense of at least 1*s.* a ton to remove their ashes. Are you aware of that ?—If they remove them to a short distance, 1*s.* per ton is soon spent.

10,557. No, they put them into boats, and the boats carry them to some point, and then they barrow them out ?—At Wakefield they have that advantage in getting rid of the ashes which we have not here.

10,558. There is wheeling into the boat, loading and wheeling out again, and it is a considerable expense to which they are put ?—Yes.

10,559. You gave us the number of pieces which you considered were dyed in this neighbourhood. Could you furnish us with the same information as to the quantity dyed in 1841, 1851, and 1861, in order to show what the gradual increase has been ?—The increase has not been very gradual, but very rapid. I should say, in round numbers, that the piece trade of the district has doubled itself from 1841 to 1865.

10,560. If we take the 7,000,000 pieces which are made at present, it would be 3,000,000 in 1855 and 1856, and 1,500,000 in 1845 and 1846 ?—It is only a very rough guess. The difference between the class of goods which are made now and those which were made 20 years ago is so great that a comparison of them would give a fallacious view of the trade.

10,561. Would the weights differ ?—Yes, and the character of the goods altogether. 20 years ago the great mass of the goods were made of wool, whereas now they are made of mixed cotton and wool. These

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have increased very much in quality, but the weights have decreased; the conditions are so completely different that you can only take the money value.

10,562. Can you state what the money value would be?—I think that in money value you get something like correct data. I should say roughly, in reference to piece goods, that the money value has doubled itself twice at least. With regard to yarns the increase has been very much greater than that. The export trade of this district in yarns in 1844 was 1,500,000*l.* and last year it was nearly 6,000,000*l.*, that really comes to the same result.

10,563. In estimating the number of pieces which are prepared in the district, did you take into account the pieces that are sent to Leeds to be dyed?—Yes; they are only a very limited quantity as compared with those that are dyed in Bradford. 20 or 30 years ago the stuff-trade so far as regards the merchant which is now carried on exclusively here was carried on in Leeds. At that time a merchant being there had his goods dyed there. The stuff-trade has entirely ceased to be carried on in Leeds. Every merchant, both in the home and the foreign trade, who is engaged in business to any extent whatever, is located here, and the accidental fact that goods are taken to Leeds to be dyed now in limited quantities arises in this way, that dyers have long existed there, and so long as they continue to manage their business well and have a fair supply of water (which is a more material question than the question of carriage between Bradford and Leeds), those parties will probably continue there as dyers.

10,564. Do you attribute in a great measure the removal of the dyeing trade from Leeds to Bradford to the circumstance of your having a superior quality of water, and water in abundance?—No, I attribute it simply to the fact of the merchants being here I have no doubt that if there had been plenty of water here at a cheap rate, instead of not more than one half of the goods which are used here by the merchants being dyed on the spot, nine-tenths of them would be dyed here. At the present time there is no supply of water except at a higher rate than it can be obtained in places outside the town; at Leeds, for instance, and Wakefield.

10,565. You gave us just now the value of the goods exported from this neighbourhood?—Yes.

10,566. Can you give us any estimate of the value of the raw material used in carrying on that trade?—Only very approximately. If you take the quantity of wool required for the 6,500,000 or 7,000,000 pieces that are made here at an average weight of 6 lbs. of raw wool, that gives 42,000,000 lbs. of raw wool; you may add probably 2,000,000 or 3,000,000 lbs. for the class of goods which are heavier than the general average, making altogether from 40,000,000 to 45,000,000 lbs. The export of yarn trade, representing a value of about 5,500,000*l.*, will consume from 35,000,000 to 40,000,000 lbs. of wool, according as the wool used is wool in the grease or washed wool. The trade from this country in yarns to Scotland, Norwich, Lancashire, and other places, is very difficult to calculate, and it is only a guess; the other may be taken on very sound data at about from 25,000,000 to 30,000,000 lbs. of wool. That would bring the consumption of wool, in round numbers, to from 100,000,000 to 120,000,000 lbs. I do not think it can be brought to any more definite calculation. It is about, say, 110,000,000 lbs. of wool.

10,567. At what price would you put the wool?—The price of the wool has ranged very high indeed during the past two years. It is somewhat lower now, and may remain so, but if you take it at 2*s.* a pound you would get about 11,000,000*l.* as the value of the raw material.

10,568. With regard to the materials for dyeing, is any shoddy used in the stuff district?—No, not in this district.

10,569. Besides the wool you have the dyewoods and other materials which are imported, what is the value of them?—The other great article of consumption is cotton warps.

10,570. What would the cost of the raw material be?—It is not in a state of raw material; the cotton is in a state of warp when it is brought here. The value is estimated to be about 4,000,000*l.* I should have said between 3,000,000*l.* and 4,000,000*l.* per annum.

10,571. The materials used for carrying on the processes of dyeing, I mean the dyewoods and things of that kind, what value would they represent, taking the whole district?—The value of the soap and dye wares and oil (although it is the merest guess), I should think would be under 500,000*l.*

10,572. The difference between all these items added together, and the 24,000,000*l.* or 25,000,000*l.* which you have given as the value of the goods produced, would represent the industry of the neighbourhood?—Yes.

10,573. Can you tell us what proportion of British and foreign wools you use in this neighbourhood?—That is a very difficult question to answer. The greater proportion of it is English wool.

10,574. Have you any means of judging of the weight of British wool produced in the country now?—Yes; we have happily got some very good data, the recent statistical returns to the Board of Trade, giving us the number of sheep in the country.

10,575. What is your calculation of the annual produce in British wools?—150,000,000 or 160,000,000 lbs., probably about 140,000,000 lbs. of washed wool are about the annual produce.

10,576. Can you give us the weight of wool imported in different years for some years past into England?—The weight of wool imported, according to the last completed returns of the Board of Trade, was 238,000,000 lbs., of which about 56,000,000 lbs. were exported, leaving 182,000,000 lbs. kept for home consumption.

10,577. Was that last year?—No, the year before.

10,578. Can you give us the weight in any periods previous to 1864?—No.

10,579. Taking both the worsted and the woollen trade carried on upon the Aire and Calder, can you give us a close approximation to the quantity of wool manufactured within those basins?—No, I cannot. I should prefer confining my answers to the worsted districts.

10,580. I wish to ascertain what the importance of your woollen trade is in the West Riding as compared with the woollen trade of the whole country. Is it not very large?—Yes; it comprises the greater proportion of it no doubt.

10,581. You have given us the volume of water that you pump respectively from old colliery workings and from the flagstone below?—Yes.

10,582. From the one source you pump 1,000,000 gallons per day, and from the other from 500,000 to 600,000 gallons a day. From what depths do you pump those quantities?—The old colliery workings immediately under my lands at Bowling are from 120 to 130 feet deep.

10,583. Varying from a maximum to a minimum level?—There is an outflowing sough which runs into Bowling beck, that is when the colliery workings are full; they do not vary more than 10 or 12 feet in depth.

10,584. From what depth do you pump the other water?—The flagstone is about 50 yards below the colliery workings.

10,585. What expense do you incur in pumping that water?—It is so mixed up with the operations which are carried on that it is quite impossible to give the expense separately.

10,586. Do you cleanse the wool as well as dye it?—The pieces we do.

10,587. What do you use to clean them with?—Soap.

10,588. What becomes of the suds?—The nature

of the goods that pass through our hands is such that it really leaves no suds, it is not like scouring wool, where you have a great mass of grease, and where the liquid is thick and can be operated upon; the water which passes away from the troughs or vessels in which our pieces are scoured is considered as worth less. I mean that it does not contain any large quantity of grease.

10,589. Is it passed away into the brook?—Yes; it passes away with the ordinary dye waters.

10,590. Have you assisted in erecting any works to collect the soapsuds from other manufactories?—Yes; I let some old premises that were conveniently located to collect by pipes the soapsuds from many of the manufactories, and I have now made a fresh arrangement with Messrs. Le Page, of Wakefield, to let some new premises; they have just completed their arrangements for connecting a number of mills, where wool washing operations go on with their grease works. All the foul and greasy water which comes from the wool washing, after having been operated upon, and the grease and filth extracted from it, passes away into a drain, apparently almost as pure water.

10,591. From your knowledge of the operation, do you think that the process can be carried on so that the water shall be passed away from the soapsud works in a clear and tolerably pure condition?—Yes; from having watched the operations at these particular works and at the old works for several years, I have no doubt upon the point.

10,592. Do you think it would be any hardship if the Government required that no soapsuds should be passed into the rivers or any running streams before such soapsuds were purified?—Practically, I apprehend that legislation would be useless on that point, because manufacturers, wherever they have the opportunity, are using the means which are now at their disposal to obtain money for their soapsuds.

10,593. Are you aware that up to this time not one-half of the soapsuds have been reclaimed?—I can quite believe it, because in matters of this kind operations are so slow.

10,594. But as manufacturers have a pecuniary interest in carrying out the system a little extra pressure would not be injurious, would it?—It is not altogether that, but the time and circumstances which the parties have not the least within their control; for instance, until within the last three months two or three of my tenants could not possibly have used these premises, they had no means of getting access to them until just now, although they were wishful to do it. You must give time in all these cases to effect changes, however desirable they may be. I can now give you the imports or quantities of foreign wool kept for home consumption during the three decennial periods I have mentioned; in round numbers, in 1844 it was 64,000,000 lbs.

10,595. What was the raw wool worth in 1844?—That will require a little consideration. The weight in 1854 was 82,000,000 lbs., and in 1864 it was 182,000,000 lbs.

10,596. So that it has very nearly trebled since 1844?—Yes.

10,597. Do you suppose that there has been any great increase in the weight?—Some time ago I stated that I thought the trade had twice doubled itself in the past 20 years, of which I have the proof here. The exports in 1844 were 9,000,000*l.*, and the exports in 1864 were 24,000,000*l.*; those are only exports.

10,598. Can you put in any papers containing these statistics?—Yes; whatever may be applicable shall be handed in.

10,599. Do you think that there is any great difference in the weight of British wool which is produced in the country now and that which was produced in 1844?—We have no data by which to judge of the quantity, except this fact. The prosperity of the district since the panic of 1858 has been almost unprecedented, uniform and continuous to an extent that I never remember before. One result of that was that commencing in 1861, and going on to 1864 it was found that the stock of English wool was very gradually but evidently decreasing in the country; in some districts, I know that in 1863 and 1864 there was none, it had all been sold; we know that to be a fact. The stock of English wool which is now held in the farmers' hands is a very considerable amount. The consumption has been going on more rapidly than ever, and I think I need give you no other proof than this, that the increase in the number of sheep has been very great during the last seven years.

10,600. I kept for some years a Southdown flock, some 12 or 15 years ago. I found that the short Southdown wool sold the best, but of late years I have found that it was better to have cross-bred sheep, or long-wool sheep, as there was a greater demand for the wool, and it brought a better price?—That illustrates the fact which I named to you in reference to the competition between this country and France. Many years ago we had a considerable trade in fine goods that were sent to France, and also to America, and were also used for the home trade, all made from the Southdown and similar wools. Now not only do the French supply America and other countries where we sent a class of fine goods, but there is not a piece made in all this district to compete with what are called French merinoes. The increase of Australian wool has tended to lower the price of the Southdown wool.

10,601. The tendency is to increase the long-wool sheep of this country, and consequently the whole produce of Great Britain?—The great want of this district, and what we encourage farmers to produce is long bright-haired wool.

10,602. In the weight of the foreign wool which you mentioned, did you include the Alpaca and Mohair?—Yes.

10,603. (*Chairman.*) Has the Scotch trade increased as rapidly as the Yorkshire trade in light goods, such as those made in Galashiels?—That is not a trade to compare with ours; it is more a woollen trade. Glasgow and Paisley are the two principal places where goods of a similar character to ours are made.

10,604. Has that trade increased as fast as yours?—I think not; it has increased very largely, no doubt. The yarns for that trade are principally sent from this district.

10,605. Did the American war interfere with the Yorkshire trade either to retard or promote it?—For a few months, at the commencement of the American war, there was a general fear that we should have a panic in consequence of the absence of the American trade, but the result was that after a few months had passed the American trade was perfectly healthy and continued so during the whole period of the American war. I believe the American merchants never made so much money in their lives as they did during that war. The Bradford trade was never more prosperous in consequence of the steady continuance of that trade.

10,606. What is the amount of duty charged upon English goods that are conveyed to America now from Bradford?—It is very heavy; on an average 50 per cent. nearly.

10,607. Has that duty been put upon the goods since the cessation of the war, or was it put on during its progress?—It was gradually increased during the war; there has been no increase since the war, I think; it was increased up to 50 per cent.

10,608. And remains at that amount now?—Yes; but notwithstanding that the Americans have taken, speaking generally, larger quantities of our Bradford goods.

10,609. Is there a similar duty upon goods sent from France?—I believe French goods pay the same duty, it is a general tariff.

10,610. What weight of coal do you burn per annum?—Over 20,000 tons.

10,611. Have you considered the question of smoke prevention in burning your coal?—I have been

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turning my attention to that subject latterly, and I think the time has come when we have had sufficient experience to base some general plan for the consumption of smoke, some plan applicable to all.

10,612. Have you tried any specific plan?—From time to time during the past 20 years I have seen tried several plans, many.

10,613. Did you ever see a plan tried that appeared to you to accomplish the object?—I think I have seen plans that appeared to answer, the parties apparently have been satisfied with them, but ultimately they have fallen into disuse, or a difficulty has arisen. I think we have sufficient data now on which to base some general action as to smoke consumption, and I ventured to express an opinion some weeks ago, that we should see a very great change in Bradford in two or three years in that particular.

10,614. Is a bright or clear atmosphere an advantage to the Bradford trade?—No doubt of it.

10,615. Do the soots and smoke which pervade the town now injuriously affect the goods?—I have no doubt that very great injury and great loss are sustained in consequence of the sooty state of the atmosphere.

10,616. Have you ever put in operation any kind of patent for preventing smoke?—Yes, and hitherto they have all been laid aside. It is almost premature to speak of them, but we have two plans, not speculative plans, which I believe will be applicable under different circumstances, and which are to be worked out in a few weeks. I have the greatest faith in them. I believe that one or the other, according to circumstances, will certainly be a smoke cure, and without doing injury to the boilers, which is really a great and vital question, and which has hitherto been the great difficulty.

10,617. Has it occurred to you in working your boilers that instead of dealing with the patentee you had better deal with your own fireman?—Yes; that is all very well, and in some cases it can be worked out by the fireman, if you have an intelligent man, and there is plenty of boiler space, that is to say, where he has not to force his fire; but no man can burn the smoke where he is compelled to raise a given quantity of steam in a given time, if his boiler space is not more than equal to the raising of that steam, or without pressing upon his fire after he has thrown coal upon it, and stirring it up to raise an extra quantity of steam.

10,618. Are you quite sure of that?—I think that there can be no question about it. If you should adopt some system of smoke burning, which is beyond the control of the fireman (and I believe that we shall never get to smoke burning thoroughly satisfactory until we do use such means) by which he cannot force his fires beyond the power of the apparatus with which he is working, and consequently, if that apparatus is working rightly, and has once burnt its smoke, it must continue to do so.

10,619. Smoke prevention, in fact the combustion of fuel, is to a great degree a chemical operation, is it not?—I will not venture to say. It is perhaps partly a chemical operation, and partly a mechanical one.

10,620. It is the conversion of a solid into a gas?—Yes.

10,621. The smoke consists of the finest solid particles of the fuel?—No doubt.

10,622. That, we say, is visible smoke?—Yes.

10,623. There would be the same amount of material passing up the chimney if smoke were prevented, but it would be invisible?—I am not sure about that. I should say that there would not be the same amount of material passing up the chimney, not the same material substance at all events.

10,624. If you pass 10 tons of coal into a furnace, and if during its combustion you continue in one case to produce dense black smoke, and if in the other case you consume the whole of the 10 tons without any but parliamentary smoke (and by parliamentary smoke I mean smoke which can be seen through), would not the same weight of coal in both cases pass up the chimney; would not the same products of the coal pass up the chimney?—No; in the one case you pass up the gases which have been produced by the perfect consumption of the coal, and in the other case you pass up the particles of coal itself.

10,625. But still, weight for weight, the same 10 tons are passed?—On the same principle you might say that the whole weight of the coal which you throw into the fire goes up the chimney.

10,626. If the residuum of the ashes is one ton in each case, there is no other means of escape for the whole substance of the coal either as smoke or as a gas, except up the chimney, is there?—Of course not.

10,627. Then you pass the same weight in both cases?—I am not sure about that, whether the weight of the gas is equal to the weight of the coal.

10,628. There is no such thing as annihilation,—combustion is the conversion of one thing into another, in the case of coal, a solid into a gas, less or more transparent as the combustion or conversion is less or more perfect?—It is.

10,629. (*Mr. Harrison.*) It must all go up the chimney in one shape or another?—Yes, it goes up the chimney in the shape of smoke, soot, or gas.

10,630. (*Chairman.*) You say that if you have to force your boiler to make steam you must make smoke?—Yes.

10,631. Of course the fact of making smoke shows that you retard the generation of steam, and it arises from the method of firing. A man now, in order to force his boiler, and to save himself trouble opens his fire-hole door, and sends in say two dozen shovelfulls of fuel right up to the bridge, as far as he can scatter it in; he covers the whole living fire with a coating of black cold fuel which so chills his fire as to prevent the combination of the gases at a sufficient temperature to consume the carbon which is roasted off from the coal?—It depends upon the man. I have seen men do it in both ways.

10,632. If you make black smoke you may rest satisfied that your fireman is sending in coals over living fire as far as he can throw them?—Then he must pick his bars in order to make the coals consume more rapidly.

10,633. If the fireman pressed the fire from the front and threw the coals on the dead plate in front, then the carbon would slowly roast out?—That, no doubt, is the sound theory of smoke burning.

10,634. I would undertake to fire the worst set of boilers, and the heaviest worked set of boilers in Bradford, and to produce the same amount of steam, and not to send anything up the chimney but parliamentary smoke?—I would select the coal for you, coal producing a very small amount of carbon.

10,635. It shall be the same coal as that which those boilers are ordinarily worked with?—If that is the case we have something to learn, and it is high time that we learned it.

10,636. (*Mr. Harrison.*) Can you state what weight of coal is consumed in the worsted districts?—I could not, without a good deal of calculation, give any approximate idea of the quantity of coal consumed here.

10,637. (*Chairman.*) I think that the School of Mines publish yearly the entire product of our coal mines in this country?—Yes.

10,638. And there is a coal commission which is about to sit upon the subject?—Yes.

10,639. (*Mr. Harrison.*) You have the Board of Trade returns?—I do not think that they go back beyond 1844.

The witness withdrew.

Mr. George Edward Mumford (Bradford) examined.

10,640. (*Chairman.*) What do you wish to state to the Commissioners?—I wish to make some explanation with reference to the Bradford Canal Company. I am solicitor to the Bradford Canal Company.

10,641. What are the points which you wish to explain?—It is of great importance to my clients that the explanation should be made, and that is the reason why I tender it. It has appeared from the evidence which has been given that the injunction is against the canal as a nuisance, and that it is the canal company's fault that the nuisance exists. Now the injunction really is against taking the water of the Bradford beck so as to create a nuisance, not that we are not entitled to the water of the beck, but simply that we are not to take it now that it is in such a state as to create a nuisance. It has been stated that we have no statutory powers to take the water of the beck. It is rather of importance that it should be explained that we have full statutory powers to take the water of the beck; we are entitled to it. I shall be able to hand in documents to you which prove that fact conclusively and beyond doubt. Three out of the four judges stated in their judgment that we were entitled so to take the beck water. The decision was simply on the ground that the water of the beck was in such an offensive state as to create a nuisance, and that therefore we were for the present debarred from taking it. If the beck is ever rendered pure and clean, we shall be entitled to our supply from it as heretofore. I think that I should give to the Commissioners a copy of the Bradford Canal Act. I have marked the parts in which we are authorized to take, "all such streams and watercourses as shall be found in making the said cut or canal." There are other provisions, but those are the special provisions. I will give to the Commissioners a tracing of the plan which was deposited at the time of applying for that Act of Parliament, which shows the intended line of canal; it shows the Bradford beck, and it shows the two points of intersection. I can put in a copy of the shorthand writer's notes of the judgment in the Court of Queen's Bench. The other judges allude to the point, but Mr. Justice Shee specifically says, "On "looking to the Acts of Parliament it appears that "the company were authorized to take water for the "purposes of the canal from the beck, which at the "time the legislature authorized the taking of the "water was sufficiently pure," &c. Then I believe that the affidavit of Mr. Leather was handed in yesterday. That affidavit was of course simply made for the plaintiffs, and was an ex parte statement. I will hand in a copy of the evidence on both sides. I will not trouble you to read it; it is simply for your use if you wish to refer to it. You will see that on our side we consulted equally eminent engineers; we analyzed Mr. Leather's suggestions, and the result was that we found that they were entirely impracticable; they could not be carried out; the Bradford Canal Company would have been happy to do so if it had been possible. I will also give you a copy of the answer of the defendants to the information which was filed in the Court of Chancery, which will show you the grounds of defence which they had, and the position of the canal company. The only other reference which I have to make to this part of the case is to a statement which I observe has been made by one of the members of the corporation who has been examined, Mr. Godwin. Mr. Harrison says, "Therefore the canal company have just ground of complaint." The newspaper report states, "Mr. "Godwin said that with regard to that point it was "difficult to speak, but he thought the canal com-"pany were bound to obtain a good supply" of water. Now if, as is very common here, the word of the corporation is taken as law, that statement in itself would be detrimental to us. The Bradford Canal Company, in their answer, set out the 25th section of the Bradford Improvement Act, 1850, to which I would specially call your attention. By that enactment the corporation are empowered to cleanse and otherwise deal with the brooks and streams in the borough as therein mentioned; and the Bradford Canal Company contended that it was the duty of the corporation, and they do contend still that it is the duty of the corporation, either to take means for preventing pollution coming down as far as the place where the water is taken into the Bradford canal, or to supply the canal company with fresh water at the expense of the corporation. As we contend, the corporation are the conservators of the town, and they have neglected the powers which they could have put in force; the town, therefore, have occasioned the nuisance complained of, and the loss and damage which the canal company will suffer by being shut up as they are substantially; the town should either have taken means to prevent the stream being in such a foul state, or they should have furnished us with a pure supply of water, or, of course, in the alternative, have paid us compensation for the damages which we have sustained.

(*Mr. McGowen.*) Of course the Commissioners do not expect us to acquiesce in that view. Of course, you gentlemen are not sitting here to inquire into matters of this description. If this were the proper time I should meet these statements.

(*Mr. Mumford.*) I should not have brought this matter before your attention at all if I had not been compelled to do so by the remarks of previous witnesses. It was not my intention to tender evidence, or in any way to take up your time.

(*Chairman.*) In looking over the shorthand writer's notes of the proceedings here, if we find that we cannot use the evidence which we have taken without prejudicing you in a legal point of view we will strike out the notes on both sides.

(*Mr. Mumford.*) My position is rather critical at this time, inasmuch as to-day application is to be made for an extension of time for the injunction. I believe that it will be granted, but if it is not granted the canal will have to be closed to-morrow; that will be a great loss and detriment to the town. We have given notice of our intention to apply to Parliament for powers to dispose of the canal, and we shall apply to Parliament for such powers. When we come before Parliament it will be necessary that we should go there with the good will of the inhabitants of Bradford, and if statements are made before you which are calculated to do us injury, I think that it is my duty to set them right.

10,642. (*Professor Way.*) You know that the evidence taken here has no legal value?—Not at all.

10,643. And that we do not express an opinion upon it?—Certainly. I merely wish my observations to have the same publicity as has been given to the other statements which have been made. Your object, I believe, is to improve the condition of the streams, and I should like to show you the effect which this intended application to Parliament will have, and the additional powers and privileges which it will give the corporation. This is a plan of the canal company's property; this is Bradford where the end joins, and this (*pointing out the same*) is the part where the nuisance complained of exists. The canal runs down to join the Leeds and Liverpool canal at Shipley. This part (*pointing out the same*) is now entirely built over by houses, and is town; the town is as it were squeezed down on both sides of the canal, and would be squeezed beyond it, but for the water and the canal company's property. The Leeds and Liverpool Canal Company have made a proposal to take the canal, and to keep it open. Undoubtedly it would be a great advantage to the town that it should be kept open, inasmuch as it is the only means of opposition to the railway company, and power would be placed in the railway company's hands if it were not kept open. But this part of the canal property (*pointing out the same*), running into the town as it does, and being the chief source of the nuisance, the canal company consider it essential that it should be closed. The large portion of land coloured green here would give great facilities for making docks and wharves, and so on, and the canal company have proposed to let the Leeds and Liverpool

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Company have so much of the canal up to this part (*pointing out the same*), but that the canal should stop here (*pointing to the plan*).

10,644. (*Chairman.*) That would shut up how much of the canal?—About 500 yards. The effect of that will be that the taking of water into the canal from the Bradford beck will be done away with. The Act will give powers to the corporation to deal entirely with that portion of the beck, to arch it over, or to do anything which they wish with it. I am not in the secrets of the corporation, but it is perfectly obvious that an improvement is very much wanted to make streets across that portion of the town where they cannot come now, and to make a road down there, and to build (as you heard the other day was very much wanted) a town hall, a post office, and to make other improvements, and the plan will be equally advantageous to the public by keeping the canal open for that distance in competition with the railway. I simply put this before you to show that the canal company have done all that they can to keep open the canal for the public benefit, that it is not their fault that the canal is closed, and that they are still anxious to make the canal beneficial to the public.

10,645. Will the land now covered with water be given to the corporation or sold to them?—The canal company have incurred a great deal of expense and I do not think that they are in a condition to give much, but must rather seek to recoup themselves for the expenditure. But I think that the town clerk, if asked for his opinion, will say that that would be a great improvement to the town.

10,646. You will sell the land to them cheap?—We will sell it to them at a reasonable and fair price.

10,647. (*Mr. Harrison.*) Had the canal company under their Act power to make reservoirs for the supply of the canal?—The canal company had power to make reservoirs under their Act. I am glad that you have asked the question, because a great deal has been rested upon the fact that they had not made reservoirs. It was not necessary. The power to make reservoirs was simply a general power included in the power to make the canal. In making the canal the company raised the water by means of a dam for which flood gates were afterwards substituted, and they found that they had sufficient water to work the canal without making reservoirs.

10,648. As the canal was polluted, did the canal company take any steps to try and prevent that pollution?—The pollution of the water, as I am informed, has been so gradual that it was not possible to take any steps, besides which the fact of the pollution being occasioned by so many people rendered any attempt to prevent it perfectly impracticable.

10,649. There is a mill, I observe, upon the plan between Bradford and the river Aire?—Yes; Frizinghall mill.

10,650. Was that mill in existence when the canal was formed?—That mill was purchased by the canal company and is now vested in the canal company.

10,651. Do you know what volume of water you use daily upon the canal for passing boats down it?—About 3,000,000 gallons a day. I have just received the following telegram from my agent, "Order made "without calling for reply. Amphlett stopped." We moved for six months further time, and I take it to be that we have six months further time, which will enable us to bring in our bill before Parliament and to make the necessary preparation.

10,652. Will the defending of the action be a costly affair?—A great expense has been incurred. It has been a very costly affair.

10,653. What may it have cost?—The costs on both sides will spoil 5,000*l.*, I should think.

10,654. (*Chairman.*) Is there anything which you would wish to add?—I should like to have one witness called for the canal company, namely, the lessee of the canal, who will tell you the state of the water which comes down the beck and the means which have been taken to purify it.

The witness withdrew.

Mr. Jeremiah Crowther (Bradford) examined.

Mr. J. Crowther.

10,655. (*Chairman.*) What are you?—I am lessee of the Bradford canal in conjunction with another person named Dixon.

10,656. How long have you known the Bradford canal?—I should think for 30 years.

10,657. In what state is the water now as compared with what it was when you first knew it?—It is very much worse.

10,658. Where do you get your supply of water from to feed the canal?—From the Bradford beck.

10,659. In what state is the Bradford beck as compared with what it was 30 years ago?—I cannot give you any idea of it, because I was not resident in the town to notice the beck.

10,660. Is the beck fouler than it was when you first knew it?—A great deal.

10,661. At what time of the year is the water in your canal in the worst state?—In summer time.

10,662. Has it a disagreeable smell then?—A disagreeable smell.

10,663. Does it affect you at all?—Not at all.

10,664. Does it affect the workmen who work upon it?—Not at all.

10,665. Does it affect the persons who reside upon it?—I have never heard any complaint from the cottagers who reside upon the sides of the canal.

10,666. Or the persons walking along it?—I have heard them complain very much.

10,667. To what points do you wish to speak as to the Bradford beck, or as to the mode of purifying it?—We have taken every step possible to keep out the heavy filth; we have put down grates.

10,668. And that does not do it?—That does not do it.

10,669. Do you dredge the canal?—We flush the top length every fortnight into the beck.

10,670. Then you send back again and on downwards what comes from above?—Yes.

10,671. Then anysolid portion which you receive you give back again into the beck so far as you can?—Yes.

10,672. Is any objection made to that?—I have not heard of any.

10,673. Do you ever dredge the canal?—We did so some 12 or 13 years back, and we then got out a great deal of dirt.

10,674. But you have not done it since?—No.

10,675. Do your boats ever ground upon the sludge at the bottom of the canal?—Yes.

10,676. And that makes it difficult to carry on your trade?—Sometimes it does.

10,677. Have you at all complained of that state of things?—Yes; the only way in which we can get quit of the dirt is by flushing.

10,678. You could dredge and take away every pound of dirt if you thought proper to do so?—Undoubtedly.

10,679. It would be far more costly?—Yes. At times great weights come down, as on a Saturday when they flush or clean out the dyehouses above, and that stops our work. If we find out when the stuff is coming down we shut down the feeding cloughs and stop it.

10,680. Has it ever occurred to you that it would be advisable to get pure water from some other source for carrying on the canal trade?—Decidedly.

10,681. Have you ever tried to do it?—No; but application has been made to the corporation.

10,682. Have you asked them to give you clean water instead of dirty water?—Yes; they have been asked what they would charge for it.

10,683. How many locks of water do you use in the 24 hours, in and out at that part?—About 32.

10,684. What length, and what depth and width are your locks?—They vary a little, they are about 70 feet,

10,685. Do you know how much water it takes to pass a boat?—Yes; I think about 61,000 gallons.

10,686. Have you any side ponds?—Yes, at various places.

10,687. Have you side ponds upon your locks to save half the water; did you ever see a lock which had a side pond?—I do not understand you.

10,688. There is a method by which you can use a lock and only waste half the water?—We have not that arrangement.

10,689. (*Mr. Harrison.*) You say that about 32 locks full in a day pass down?—Yes.

10,690. And that there are 61,000 gallons to a lock?—Yes.

10,691. That makes nearly 2,000,000 gallons a day?—Yes.

10,692. Mr. Mumford gave us 2,500,000 gallons?—There is the waste.

10,693. Say 500,000 gallons for waste?—Yes; the water is drawn over the byewash.

10,693*a*. If you got 2,000,000 gallons a day from the water company, what price could you afford to give them for it?—We could not afford to buy it.

10,694. (*Mr. Mumford.*) It would come to about 10,000*l*. a year.

10,695. (*Chairman to Mr. Crowther.*) Of what size are those locks?—They vary.

(*Mr. Mumford.*) They are 73 feet, by 15 by 9.

10,696. (*Mr. Harrison to Mr. Crowther.*) That is a little more than 60,000 gallons?—Yes.

10,697. You would have to deduct something for the draught of the boat?—Yes.

10,698. (*Chairman.*) Have you at all contemplated purifying the beck water?—It has been named.

10,699. Has any scheme presented itself to you for purifying it?—Not to carry out the thing. We could commence, but there would be such a weight of material and dirt that I do not know what we could do with it.

10,700. I believe that you have heard that your company propose filling up about 500 yards of the canal, and doing away with it?—Yes.

10,701. Where are you to get the clean water for working the other portion?—The only plan which I can see which is available would be to get water from the Leeds and Liverpool canal.

10,702. In that case you think that you could work the remaining portion of the canal without admitting the Bradford beck water at all?—Decidedly.

10,703. And then you would have a comparatively clean canal?—Yes.

10,704. (*Mr. Harrison.*) Should you have to pump water from the Leeds and Liverpool canal?—There are two projects in view—one by gravitation, and the other by pumping.

10,705. (*Mr. Mumford.*) The Leeds and Liverpool Canal Company have made a proposal to rent the whole of the Bradford canal. They have consulted Mr. Beardmore, and they say that they must go to an expense of 9,000*l*. or 10,000*l*. in putting down pumping engines to pump water from the Leeds and Liverpool canal into the top lock, at the Bradford end, from Shipley, and that the expense would be from 800*l*. to 900*l*. per annum to maintain those stations. They requested to have a lease for 21 years, and at the end of that 21 years we were asked to take their plant and engines, but we were not told how we were to take the water. Of course it was useless to suppose that we could accept that offer. We, on the other hand, suggested that it would be equally beneficial to them and to the town to have the land to the extent which I have shown you, and there would also be this advantage, that by taking off that length the water would come simply by gravitation to that point from Bingley. You will see from the affidavits of the engineers whom we have consulted that it is perfectly impossible to get pure water from any other source than from the Leeds and Liverpool canal.

10,705*a*. If steps were taken to purify the Bradford beck you would then have power, as you have now, to take that water?—Yes.

10,706. What would be the result if you allowed the proposition of the Court of Chancery to be carried out, and if your canal was stopped up for a certain time until the streams were purified, and if the water was then resumed by the canal?—Our position would be hopeless; we should have lost the traffic; it would have gone on to the railway. Bradford would be at the disadvantage of losing the canal, and the railway company could charge what they pleased.

10,707. (*Professor Way.*) You have a right to water, but not to impure water?—Yes.

10,708. And the canal for the moment is the settling tank of the beck?—Yes. In our evidence we established satisfactorily that the beck is at least as bad if not worse than the canal, and that great alterations are wanted in the beck to improve it. The effect of stopping the canal will be to turn all this water into the beck. There are large settling ponds and places in the beck where the mud will rest, and when the canal is closed the beck will be in place of the canal, and will be in fact worse than it.

The witness withdrew.

Mr. Samuel Smith (Bradford) further examined.

Mr. S. Smith.

10,709. (*Chairman.*) I think that you have some statistics which you wish to put in?—Yes. I was asked the other day with regard to some things as to which I was not in a position to state, and I had to make some inquiry from our books.

10,710. The statistics as to the refuse sent from the works and as to the acids?—Yes.

10,711. And as to the quantities of dyeing liquids?—Yes. Taking the first six months of the present year as our data, the amount of acid which we use per annum is about 300 tons liquid.

10,712. That is at your own works?—Yes; there are various acids, for instance, sulphuric and nitrate and muriatic. We possibly use about half that weight of other acids, which are crystalized, such as alum and other things which would be considered acid. Then as to an estimate of the dyeing liquors which we turn into our drain in the course of the day, I find that the quantity of liquors made for dyeing goods with varies from 40,000 to 60,000 gallons per day, and no more. All the other water which we use is used either for scouring, or for washing purposes after dyeing. In fact, by far the greater portion of the water which we use is used for washing after dyeing. A great deal of that water passes into the drain colourless, and to all appearance clear. Then I was asked respecting the quantity of water which we drew from the corporation. I see that, judging by the first nine months of this year, our consumption this year will be equal to 40,000,000 gallons drawn from the corporation source, besides what we raise ourselves. Then a question was put as to the quantity of solid matter which we consumed. I have made an approximate calculation that the dyeing materials which are insoluble are chiefly vegetable, and we do not consume 1½ tons per day upon the average. That consists of rasped woods and various other matters which we use in dyeing. Cochineal and indigo and lac dye are solid to a certain extent, but still they do not occasion any trouble in the water.

10,713. (*Professor Way.*) What is the condition of the dye when it is fixed in the cloth, is it in a soluble or insoluble state?—To prepare wool to receive colours, wool being a porous article, the colours require first the application of a mordant, and that mordant enables the colours to be fixed upon the wool or the cotton.

10,714. Take this piece of cloth; it has been dyed?—Yes.

10,715. Can I wash out the dye?—No.

10,716. It is not in a soluble condition?—No.

10,717. Then in the act of dyeing this cloth, that which was previously soluble became insoluble?—No.

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10,718. How did the dye get into the cloth if it was not soluble in the first instance?—The dye must be in solution in the first instance, and the wool must be in a state to absorb the colour.

10,719. If that be so, what is the refuse like in the dye vats when it is turned out; is it all in solution, or is some of it in suspension?—It depends upon circumstances; we have to put in solid matter from which to extract the colour, and some of it remains still soluble after dyeing.

10,720. If you put in a perfectly liquid matter, would you not have a soluble matter in your dye vats?—We use a liquid colour, and we find no solid in the vessel at all; for instance, some of the aniline dyes are used in a liquid state.

10,721. They are quite an exception to other dyes?—Yes; we have no other colours which are liquid.

10,722. Take logwood and chromate of potash, and so on; when they are mixed do they not leave an insoluble material which is fixed in the cloth?—The colour which is in the wood we get into the liquor; the cloth is in a state to absorb that colour, and as soon as the cloth is properly dyed the result is insoluble.

10,723. Taking the material which is used, do you fancy that the whole of the dye is fixed in the cloth, or that a good deal of it remains behind in the dye liquid?—It greatly depends upon circumstances. I have seen the liquor as nearly clear as possible after dyeing. In the case of some colours nearly the whole of the colouring matter is absorbed into the cloth.

10,724. In the case of aniline dyes you suppose that the whole is absorbed?—Yes.

10,725. In fact, you can make the liquid nearly colourless in the aniline dyeing?—Yes.

10,726. Is the material in the dye refuse water in solution, or in suspension, or both?—It is both.

10,727. Have you ever seen any quantity of it allowed to stand, black dye refuse for instance?—No. I do not know that I ever noticed anything of that kind.

10,728. Do you think that it would become clear if it stood?—Generally our vessels are let out at night, but there are cases where they stand, and the liquor is as clear as possible the next morning.

10,729. Do you think that it is absolutely impossible to deal with that water in such a way as to stop the black solid material and to let the clear liquid pass away?—All that is wanted is sufficient room to allow the solid matter to deposit.

10,730. That is the great trouble, is it not?—Yes.

10,731. Supposing that space was no object, you say that this water could be left to settle, and that the greater part of the solid stuff could be separated by subsidence?—The whole of the solid matter going from our dye vessels would naturally and rapidly subside if we had space.

10,732. Supposing that any scheme of filtration was suggested by which the filtering surface could be obtained in a small space, and therefore the objection to large filter beds done away with, do you think that it would be absolutely impracticable to deal with the 50,000 or 60,000 gallons of water which you use?—There would be no difficulty in dealing with the water at all, but the difficulty would be in dealing with the solid matter deposited, because, in process of time, however large the storing bed might be, it would get filled with the subsiding materials which would have to be dealt with in some way.

10,733. Supposing a mechanical filter, and that the material separated got as solid as a book, and was in a cake, like oilcake, would not the difficulty be very much diminished?—The question still remains, what is to be done with it?

10,734. Is it vegetable or mineral?—Vegetable.

10,735. Would it burn?—I daresay that it would, it might perhaps burn in a furnace.

10,736. Supposing these hard solid cakes to be manageable, and to contain say 30 or 40 or 50 per cent. of water capable of being produced, but still to be almost dry to appearance, would they not burn if they were piled up?—I fancy that they would burn.

10,737. Would they not be like peat, or something of that sort, which would be combustible?—They are nearly entirely destitute of oil, and they would not burn very readily I think.

10,738. There would still be organic matter of some kind?—The whole of that which would subside out of dye materials like ours would burn; but I do not know whether there would be any profit in it.

10,739. I am not speaking of profit. Mr. Ripley said that they had found latterly that they could burn the rasped wood after it was taken out?—We use a great deal of rasped wood, from which we extract liquor, and that wood never goes into the drain at all.

10,740. If you can burn the rasped wood, which is vegetable, and if you say that the refuse from the dye vats is also vegetable, I suppose you could also burn it if you could get it into any manageable shape?—I should say so.

10,741. Then you would not say that the matter was out of reach of a practical result if you were required to stop this material from going away with the water?—I am sure that we cannot do it at this moment because we have not space for it.

10,742. You are dealing with the question of depositing tanks?—Yes; depositing tanks must be the first step in any amelioration of this kind. The next question is how to dispose of the solid matter which you propose to be in cakes; but there would be labour in doing it, it must pass through a press of some kind.

10,743. Do you happen to have heard of Needham's press?—No, I never heard of it.

10,744. It is a press which is used very largely at this moment by the potters for separating clay from water, and through one of these machines many thousand gallons are pumped off per day, the water going off clear, and the clay being stopped. A machine to separate one ton of clay will be about 10 feet long, seven feet broad, and four feet high; that is to say three or four of these machines might be worked in this room. The clay is separated from the water, and the clay is taken out in solid cakes, at a cost of 2*s.* 6*d.* per ton of clay so separated. The potters have now ceased in a great measure to dry their clay; they wash the clay and let the sediment subside; they run off the finer part of the clay and let it subside. Formerly the slush falling to the bottom was dried in kilns, but it is now pumped into these machines. If it could be shown that the water of your dye vats could be pumped (whether with or without chemical treatment) through a press of that kind, which would let the water go clear and let the solid matter remain in cakes, would there be any prospect of that being done?—I do not attempt to give an opinion upon that point, because clay mixed with water is a very different thing from our refuse.

10,745. Your difficulty is the inconvenience of these depositing tanks?—Yes.

10,746. Would the matter have a different aspect if a press of moderate dimensions were shown to you to be capable of doing the work?—If any process at all could be shown to be practicable for relieving parties below us of any nuisance or inconvenience attached to the necessary evil of a dyehouse I should be delighted to adopt it.

10,747. I suppose that if we asked for a press to be sent down you would not hesitate to adopt it?—No; but dyeing is an evident necessity in this country, and we cannot do it without using water.

10,748. (*Chairman.*) Nor without fouling water?—

Just so; and much more water is now used than was used formerly.

10,749. Is there anything further which you wish to add?—No. I believe that I have answered all the questions which were left undecided when I was previously before you.

The witness withdrew.

Mr. David Salmond (Bradford) examined.

10,750. (*Chairman.*) In what business are you?—I am a soap manufacturer.

10,751. In what part of Bradford are your works situated?—They are situated upon the canal bank, about 400 or 500 yards from the head of the canal.

10,752. Do you use the water of the canal for any purpose?—Not at all.

10,753. Do you use water in your manufacture?—Yes.

10,754. Where do you obtain it?—It is principally town's water, and what I collect from the roofs of the buildings.

10,755. What number of men do you employ?—15.

10,756. What volume of water do you use per day?—I use about 200,000 gallons a year from the corporation.

10,757. What do you pay them per 1,000 gallons?—1*s.* per 1,000 gallons.

10,758. What weight of soap do you manufacture?—I make 30 tons per week, or about 1,500 tons a year.

10,759. What name do you give to the soap?—Soft soap.

10,760. Is it all used in this district?—Yes. I produce samples of the highest and the lowest qualities.

10,761. What portion of oil do you use in it?—In the year I import about 800 to 1,000 tons of oil; for making the soap I use about 500 tons, and I sell the remainder.

10,762. Have you any refuse in the process of manufacture?—There is the refuse from the lime and potash pits. There is a difference of nearly 20*s.* per pack between the samples which I have produced. My soap is considered of very good quality, I get 8*s.* or 10*s.* a pack more than anybody else.

10,763. (*Professor Way.*) Is that mottling a mere question of fashion, or is it a necessity?—It is merely because persons like it, I think.

10,764. That, I suppose, is done by cooling the two ingredients separately?—Yes.

10,765. About what weight of potash do you use?—I import about 800 barrels a year, from 200 to 300 tons.

10,766. What weight of lime do you use?—About 100 to 150 tons of lime.

10,767. (*Chairman.*) Have you seen the Bradford canal on fire?—Yes, many times.

10,768. What sort of appearance did it assume when it was set on fire?—There was a blue flame mostly, and it would rise six feet. I have seen the flame rise over the gunwale of a boat.

10,769. Was it accidentally or purposely set on fire?—The boys do it on purpose; they reach over and stick a match in, and set the canal on fire.

10,770. Do you think that you could set it on fire to-day?—Not to-day; in consequence of the very heavy rainfalls which we have had there is very little scum.

10,771. (*Professor Way.*) Do they stir it up first?—No; I think that the combustible elements have chiefly arisen from the soapsuds which come down the canal, and which float.

10,772. These are not bubbles of gas which burst up and catch fire?—It is a gas, but I think that it is the fat swimming on the top, which catches fire as well.

10,773. The one begins it and the other carries it on?—Yes; I have seen the flame run along like gunpowder for 100 yards.

10,774. Like a will-o'-the-wisp?—Yes.

10,775. You say that this is a blue flame?—Yes; I have seen a boat completely made blue with the flame touching it, and running along the side of it; and I have seen the flame cover the whole of the drawbridge close to my works, and the white painted wood has been turned completely blue by the flame.

10,776. Does it give off opaque smoke?—There is very little smoke.

10,777. (*Chairman.*) Have you ever known any injury inflicted by the bursting out of this flame; has it injured the boats?—I remember at one time seeing a woman with some children on a boat; (the boat drivers generally have their families with them,) and I have seen a woman shrieking and making a noise, but I do not think that the flame would injure her, because it was only there for a moment. While the gas lasted the fire burnt.

10,778. But it frightened her?—Yes.

10,779. (*Professor Way.*) Is there any strength in the flame; is it capable of setting fire to wood?—I do not think that it is.

10,780. (*Chairman.*) Is the sluice from the beck into the canal near your works?—Yes, just opposite.

10,781. When they are drawing the beck water into the canal is there any additional nuisance?—The smell is frightful.

10,782. By the mixture and the evaporation of the gas?—Yes; and the sludge which goes down into the beck is very great.

10,783. When they are flushing the canal?—Yes.

10,784. Will they fill the canal up as far as your works; you have heard what they have said about it?—I have heard what they have said about it.

10,785. Shall you be pleased or sorry?—I shall be sorry in one respect, because I expect that I shall have to pay a larger rent for my property, but I shall be glad to have the canal shut up on account of the smell. It has injured my own health very considerably. A few years ago I was obliged to go away every year.

10,786. How has it affected the health of your workmen; have you heard them complain?—Yes, they complain occasionally. I have two men away now on the sick list, but I think that that is more from old age.

10,787. (*Professor Way.*) I suppose that they may suffer from this smell without being actually incapacitated or killed by it?—Yes; it produces a nausea in the stomach, and you cannot take your food. I do not know that it has materially injured my health, but I have known many times that having gone early in the morning I have had a nausea in my stomach, and could not take my breakfast when I came back again. I now take something before I go out.

10,788. The whole of the water which is used in the manufacture of this soap goes into the soap, does it not?—Yes; we have no refuse water; we do not make any hard soap. What refuse we have goes into the lime pits, and the farmers are glad to get it for manure.

10,789. If you used hard water for making soap would it make a material difference to you?—I think so.

10,790. You do not use a large quantity?—No.

10,791. But still soft water is better?—Yes, the amalgamation is more complete.

10,792. Have you any difficulty in getting rid of your refuse lime?—We have a difficulty sometimes in getting rid of it, but when a farmer once knows the value of it he comes again.

10,793. You do not throw it into the canal?—No, we throw nothing into the canal.

10,794. If it were thrown into the canal would it tend to purify the canal if properly adjusted and managed?—Yes; a large quantity of sulphate of potash is in the lime, which would tend to purify the canal considerably.

The witness withdrew.

BRADFORD.

Mr. J. M. France.

15 Nov. 1866.

Mr. JOHN M. FRANCE (Bradford) examined.

10,795. (*Chairman.*) What point do you wish to speak to?—I will put before the Commissioners a note from Lord Robert Montagu, dated in 1864. I collected some evidence with respect to the state of the river Aire about Leeds and the sewage from that town. I also prepared information to lay before a Committee of the House of Commons respecting the amount of artificial tillage required by the farmers in the circuit of Leeds, including Bradford. I will put in those minutes before the Commissioners.

10,796. Are you in any business?—I am not in any business at present except as a public accountant.

10,797. You have taken up the question of sewage application or utilization as an amateur?—Exactly.

10,798. And you have studied the question?—Yes; and I have obtained all the information which I could from other sources, and I have studied and seen how far sewage can be applied to the neighbourhood of Leeds where I live. Some years ago I was a manufacturer of artificial manure and a considerable dealer in it. That brought me into contact with the subject, and it enabled me to see how far the sewage of towns could be generally applied to a beneficial purpose amongst the farmers, and also to see how far they would be disposed to use it if it was furnished to them. What I want more immediately to draw the attention of the Commissioners to is this, that the agriculturists of the kingdom generally have become very much addicted to the use of Peruvian guano for the growth of their crops. The parliamentary returns of late years, however, show that there has been a great reduction in the amount of guano imported, and there is a considerable probability that in a few years, perhaps in 10 or it may be 12 years, the importations into this country may almost cease. It then becomes an important question what is to be substituted for this guano. The next point to which I wish to draw the attention of the Commissioners is, that in the year 1860 I took an estimate of the quantity of artificial manure used in the district within 15 miles of Leeds, independently of fold yard manure. I have the names of the principal dealers, and the amount which they are reported to have purchased during that year, of guano and of other things, such as bones, rape dust, and artificial manures. I have the quantity and the value. In 1860, in a circuit round Leeds, the total value of guano and other tillages amounted in round figures to 143,500*l.*, and of that sum about 100,000*l.* would be actually paid by the farmers for guano. It struck me that that question would probably open a market for the sewage of such towns as Leeds.

10,799. Then would you contemplate solidifying the sewage?—The question of solidifying is a very difficult one, and I think that it is scarcely practicable from the experiments which have been carried out. The only available plan, as it seems to me, is to raise the sewage bodily to such an elevation that it would flow by its own gravity over the lands requiring it for cultivation. There seems to be no difficulty about it. I have prepared a plan at Leeds, and a similar diagram was laid before you by Mr. Filliter, of Leeds, of the quantity of land which would be available if the sewage was raised 25 feet in the immediate neighbourhood of the outfall of the Leeds sewage. That plan was coloured to show the contour lines. The raising of the sewage 25 feet from the outlet of it would enable it to cover about 5,000 acres.

10,800. (*Professor Way.*) Did not Mr. Filliter say that he could get another 5,000 acres?—Yes, by another elevation. That is the district over which the consumption of guano here prevails. There is another question which is involved in the application of sewage, namely, the expense of raising the immense quantity of water mixed with it, to the amount of 4,000,000 gallons, which the Leeds people are throwing into the sewers; there is a difficulty too in dealing with the question of storm water.

10,801. (*Chairman.*) The Leeds sewage is now 8,000,000 gallons?—Yes; but in 1860, the time which I am speaking of, it was about 4,000,000 gallons, and of course it would constantly increase. I have tried some experiments which I exhibited before the Committee at Leeds under the Diseases Prevention Act, and which were laid before the board of guardians. The town council threw cold water upon it, but the board of guardians requested me to attend before them, which I did, and I showed at how very little expense the sewage could be deodorized so as to render it nof offensive to the neighbourhood. I also showed that the sedimentary matter, instead of being deposited, could be raised. In the case of a still sewage like that at Leeds, where the sewage goes at a very slow pace, the mixture of a liquor which I prepared, and which consisted of a strong solution of salts, at boiling heat, would throw the whole of the sedimentary matter of the sewage to the surface; the whole of the mechanically suspended matter was immediately thrown to the surface.

10,802. (*Professor Way.*) Those are salts which are first boiled?—Yes, and then they are put to the 8,000,000 gallons of water. The quantity of salts required is very minute compared with the quantity of water; about one gallon of a strong solution of salts (I use a triple salt) would convert at least 10,000 gallons of the sewage and make it comparatively clear, it converts the floating matter into a kind of flock; there appears to be an evolution of gas which carries the flock to the surface. I would then raise the surface water by means of a float wheel and would take the body of the sewage along with the liquor to a higher elevation, and so dispose of it, and let the clear water run into the river. It appeared to me that the salts which I used had the chemical effect of fixing the phosphoric acid and the ammonia and the other acids in solution, that they were fixed and mixed up with this floculent matter, and the whole would be available for the cultivation of crops whilst the substratum of water would flow comparatively free from acid or any poisonous matter. It appeared to me that an experiment of that sort was required to prevent having to deal with the increased body of water which is constantly flowing from large towns.

10,803. (*Chairman.*) Have you analyzed the effluent water of the sewage after it has been treated by the salts which you speak of?—No, I merely judged by the taste and the appearance of it.

10,804. Do you know that, so far as chemists have yet gone, any mode of treating sewage which separates the solids but very slightly affects the salts in solution?—That is as I understand it. The valuable part of the sewage is in solution.

10,805. And under any treatment which has yet been proposed it remains in solution?—There would be a small waste, but it appeared to me from the taste and the appearance of the water that the acids were completely neutralized. Whether the phosphates were re-dissolved I do not know, but I think that they were converted into an insoluble salt. I used salt of magnesia.

10,806. (*Professor Way.*) You know that phosphate of magnesia is to a certain extent soluble in water?—I used magnesia, but it appeared to me to convert the phosphate of magnesia into an insoluble salt which rose to the surface buoyed up by the gases which were liberated. The inference which I drew from the action of the salts was that the rapid action and the evolution of gas at the same time from the soda contained in the water buoyed up the fatty matter, and that the phosphate of magnesia and all rose to the surface. Apart from the question of deodorization it struck me that we could thus get the floculent matter contained in sewage more rapidly than by letting it deposit.

10,807. (*Chairman.*) Have you read the Reports of the Royal Commission appointed to inquire into the utilization of sewage?—I did so in 1862, I think.

10,808. There are three Reports by a Special Commission. Professor Way was a member of that Com-

mission. Mr. Lawes, the great agriculturist, was another member of it. Lord Essex represented the House of Lords, the late Mr. Ker Seymer represented the House of Commons; Dr. Simon, the late Dr. Southwood Smith, the late Mr. Austin, and myself were also members of the Commission?—I remember those names very well. I have not seen the reports of that Commission subsequent to 1862. I would merely wish to say to the Commissioners that, whatever method is discovered for dealing with the sewage, it is very requisite for the country that it should be applied as soon as possible.

The witness withdrew.

Adjourned to to-morrow at 11 o'clock, at Halifax.

Subsequently to the inquiry at Bradford the Commissioners received the following letter:

Gentlemen, Bradford, 17th Nov., 1866.

Having been from home I was sorry to find that the inquiry of the Commission on the Pollution of Rivers here had closed without my having had the opportunity of offering my opinion on one or two points which I have not seen in the evidence given in Bradford and other places.

I have been an employer of thousands for the last 40 years, during which period no nuisance has been created in connexion with the works of my firm (Walkers & Co.) by either the gasworks, wash-houses, or privies. The tar and gas water are sold at a good price and regularly carted away in close barrels. The soapsuds are subjected to an operation which extracts the grease and animal matter, for which a considerable sum is obtained. As regards the privies they are so constructed as to receive all refuse into closed carts, which, when full, are drawn out in the night and carted away by farmers into the country, who also pay a certain price for the same.

On these grounds, and because of the practicability of avoiding nuisance if proper legislation were entered upon I consider that all the refuse of houses could be collected and utilized I think that each householder should be required to arrange for the removal of these things daily or weekly, or as the case may require. I need not advert to the imperative necessity of saving all these things for manure, as we have the highest testimony that if we continue to waste them the produce of the soil of this country must necessarily fall off seriously. The mode I would pursue is in all new buildings to have a large pipe into which smaller pipes might convey all the contents of waterclosets, &c., and this large pipe should fall into a close box or cart sufficiently large to contain a ton or tons of refuse. That this cart should be placed in an arched receptacle on the ground floor, level with the street. That neat cast iron doors should be placed at the entrance, which could be opened for the purpose of drawing out the full cart and placing therein an empty one. And as regards houses that have been built sometime all persons should be required to make similar provision within a certain time. These carts should be conveyed to the nearest railway station in the night to the destination, which might easily be arranged by contract with farmers who now pay immense sums for guano and other expensive manures, not much more valuable than the refuse I am alluding to. No doubt the undertaking would be a great one and expensive, but yet it is quite practicable and would be remunerative and profitable. Manure stations would be provided by the railway companies as they would find it a source of large revenue. I ought to have said also that the builders of houses in blocks or streets might so place the main pipes as to have them to serve for more houses than one. This is pretty much what I wished to state to the Commissioners on this subject.

I also wished to allude to the making of reservoirs, which in my opinion are constructed on so large a scale as to be dangerous in many instances, and by experience they have proved so to the great destruction of life and property.

I think that no single reservoir should be made beyond a certain safe size. Why not, when a large supply of water is wanted, construct two, three, or four instead of one along side each other, and let a pipe from each unite at a little distance in a larger one? Thus the limited size would prevent any dangerous pressure during high winds or floods, which is the great point to be obtained for the public safety. I will add no more except to confirm the opinion generally offered, that no good will be done except by imperial legislation, and for this the country is fully prepared.

I am, Gentlemen, your obedt. servant,

To the (Signed) W. WALKER.

Commissioners on the Pollution of Rivers,

&c. &c. &c.

The following Statistical Tables relative to the woollen and worsted trades were furnished to the Commission by Mr. Jacob Behrens, vice-president of the Chamber of Commerce of Bradford.

A.

ESTIMATE of the PRODUCE of WOOL in the UNITED KINGDOM, from 25,795,708 Sheep based upon a RETURN made for GREAT BRITAIN on the 5th March 1866 and for IRELAND in 1865.

MEM.—The number of sheep in Ireland under one year old is supposed to bear the same proportion to the whole number as that given in the Return for Great Britain.

	Number of Sheep.		Weight per Fleece.	Wool produced.
	Under one year old.	One year old and above.		lbs.
In England - -	4,505,345	10,620,196	6½ lb.	69,031,274
„ Wales - -	380,354	1,287,809	5½ „	7,082,950
„ Scotland - -	1,624,638	3,630,439	6½ „	23,597,853
„ Ireland - -	1,043,491	2,640,251	6 „	15,841,506
„ Isle of Man & Channel Islands.	24,489	33,196	6½ „	215,774
	7,583,817	18,211,891		
Under one year old Hoggets.	5,583,817	- -	6 „	33,503,293
Lambs killed and clipped	1,000,000	- -	3 „	3,000,000
Do. not clipped	1,000,000	- -	0 „	0
				152,272,650

Bradford, 12th December 1866. (Signed) JACOB BEHRENS.

B.

ESTIMATE of the QUANTITY and VALUE of WOOL and similar material worked up in Worsted and Woollens.

MEM.—Imports, Exports, and Values from Board of Trade Tables for 1864, except quantity of English Wool, for which see A.

	Produce and Imports.	Exports.	Retained for Home Consumption.	Price per lb.	Value. £
English Wool -	152,272,650	7,320,299	144,952,351	2/4½d.	17,213,075
Foreign „ -	206,473,045	55,993,803	150,539,242	1/6½d.	11,123,905
Goats' Hair or Wool.	4,737,330	- -	4,737,330	2/8½d.	650,191
Home-made Shoddy.	52,000,000	- -	52,000,000	5d.	1,083,334
Imported Shoddy	22,482,880	- -	22,482,880	4½d.	494,611
Wool Extracts -	5,000,000	- -	5,000,000	6d.	125,000
Foreign Yarn -	4,479,984	- -	4,479,984	4/6d.	1,008,004
	447,445,889	63,254,102	384,191,787	£	31,698,120

Bradford, 12th December 1866. (Signed) JACOB BEHRENS.

C.

The EXPORTS of WOOLS, TISSUES, and YARNS, and the Quantity of Foreign Wool worked up in the years 1844, 1854, and 1864.

	—	1844.	1854.	1864.
Exports of English Wools -	£	535,134	734,490	673,446
Do. Worsted Yaarns -	£	958,217	1,557,459	5,417,377
Do. Wool Tissues -	£	8,204,836	9,121,186	18,533,457
Do. British produce -	£	50,642,306	97,092,308	160,449,053
Foreign Wool retained for Home Consumption.	lbs.	63,741,087	81,654,711	155,276,572

BRADFORD.

Mr. J. M. France.

15 Nov. 1866.

COMPARATIVE PER-CENTAGE of the EXPORTS of WORSTED and WOOLLEN Manufacturers to the other textile fabrics in 1864.

Exports of Worsteds	£16,217,898	17½ per cent.	} 6 per cent.	
Do. Woollens	7,732,976	8⅓ „		
Do. Cottons	54,882,329	59 „		
Do. Linen and Jute	11,636,049	12½ „		
Do. Silks	2,274,927	2½ „		
Totals	£92,744,179	100 per cent.		
Total Exports of British produce.	£160,449,053			

Bradford, 12th December 1866. (Signed) JACOB BEHRENS.

D.

ESTIMATE of the VALUE and WEIGHT of WOOL and similar material manufactured into Worsted and Woollen Yarns and Tissues in the UNITED KINGDOM 1864.

35,000,000 lbs.	English Wool exported as yarns	-	Value	£5,500,000
110,000,000 „	do. manufactured into tissues	4/ „		22,000,000
150,500,000 „	Foreign do. „ „ „	3/ „		22,600,000
4,700,000 „	Mohair do. „ „ „	5/ „		1,200,000
4,500,000 „	Foreign yarn „ „ „	8/ „		1,800,000
79,500,000 „	Shoddy and extracts „ „	1/ „		4,000,000
	Cotton, yarn, and other material -	- „		7,300,000
384,200,000 lbs.				£64,400,000

Bradford, 12th December 1866. (Signed) JACOB BEHRENS.

E.

ESTIMATE of the VALUE and WEIGHT in 1864 of the WOOL and similar material worked up with it into WORSTED and WOOLLENS for EXPORT and HOME CONSUMPTION.

MEM.—In this Estimate all English Wool is considered as worked up into Worsted, and that which is worked up into Woollens is supposed to be more than balanced by the Foreign Wool (Russian, Australian, and others) in Worsteds.

WORSTEDS.

EXPORTS.

£5,417,377	Yarns (31,824,296 lbs.) equal in Wool to -	-	35,000,000 lbs.
7,945,633	Goods ¼th mixed with other material £6,000,000 Wool - - - - -	4/	30,000,000 „
2,852,815	Do. all Wool - - - -	4/	14,000,000 „
	HOME.		
13,200,000	Do. mostly mixed with other material	4/	66,000,000 „
1,200,000	Do. of Mohair „ „ „	5/	4,700,000 „
2,984,175	Cotton and other material worked up with the above, exclusive of exports -		
£33,600,000			149,700,000 lbs.

WOOLLENS.

EXPORTS.

£1,186,815	Goods mixed with ¼th of other material £890,000 - - - - -	1/	18,000,000 lbs.
6,546,161	Do. all Wool (foreign) - - -	3/	43,500,000 „
	HOME.		
16,000,000	Do. of Foreign Wool - - -	3/	107,000,000 „
1,800,000	Do. do. Yarns - - -	8/	4,500,000 „
3,200,000	Do. Shoddy and Extract - -	1/	61,500,000 „
2,067,024	Cotton and other material mixed with Wool.		
£30,800,000			234,500,000

Bradford,—12th December 1866. (Signed) JACOB BEHRENS.

Halifax, Friday, 16th November 1866.

PRESENT:

ROBERT RAWLINSON, ESQ., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, Esq. | Professor THOMAS WAY.

WILLIAM WIGHTMAN, Esq., M.D. (Halifax), examined.

W. Wightman, Esq., M.D.

10,809. (*Chairman.*) You are resident in the borough of Halifax?—I am.

10,810. How long have you resided in Halifax?—Rather more than 10 years.

10,811. I believe you were mayor of the borough last year?—Yes.

10,812. You are now an alderman of the borough?—Yes.

10,813. Are you chairman of the Sanitary Committee?—Yes.

10,814. Can you give the Commission any opinion as to the sanitary condition of the borough; is it at all affected by the foul condition of the streams?—The borough is at present in a very much better sanitary condition than it has ever been, for many years ago it was in a very bad state from want of drainage, and ill-ventilated houses, and people being crowded together, and cellar dwellings, and many other causes, but latterly the sanitary committee and the corporation generally have done so much towards improving the condition of things that the health of the town is very much better than it has ever been. I believe it ranks now with any town in the kingdom of the same size and condition, as far as the rate of mortality goes.

10,815. As a corporation, I believe, you have carried out waterworks?—Yes, to a considerable extent.

10,816. Is the water of a very pure character?—Very pure indeed; it is superior to what is generally met with elsewhere.

10,817. You have carried out, I suppose, a system of sewerage?—Yes, we have, an extensive one. The sanitary committee have paid considerable attention to that; they are ventilating the sewers at the present time. We wished to know what was the best system of carrying that out, and we have been waiting for information.

10,818. What is the present rate of mortality as compared with the past?—Our borough has been very much increased in area this last year, and therefore we are not able to say comparatively what the rate of mortality is; but it is something like 24 per 1,000 this year, but that includes the deaths in the union of many individuals who come from out districts, and who die there very shortly, and these deaths ought not to be put down to the borough.

10,819. Do you know anything of the streams beyond the borough?—Not much.

10,820. Are there any manufacturers above upon the streams out of the borough?—Yes, there are some.

10,821. Supposing the people of Halifax did all they could do to sweeten and purify their own district, do you think that would be setting so good an example that all parties outside the borough would necessarily follow it, and purify their districts?—I think purification ought to commence at the head of the stream; the water ought to be pure before it comes here.

10,822. Some jurisdiction is necessary beyond your own borough?—Yes.

10,823. If any interference takes place with the streams, I suppose you would say that it should be general and not special; not that one borough, or one set of manufacturers should be interfered with, but the whole?—Yes.

10,824. (*Mr. Harrison.*) From your own knowledge,

HALIFAX.

W. Wightman, Esq., M.D.

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as a medical man, practising in Halifax, can you testify to an improvement in the health of the population?—Yes, I can. Halifax is very advantageously placed as to rainfall; we have it here very heavy, which is very important, because it washes out our drains and sewers, and that has been one means of reducing the unhealthiness of the neighbourhood and making the town better. Four or five years ago the death rate was 34 per 1,000, now it is something like 24; I am speaking of the borough of Halifax; but one reason why the rate is so much reduced may be owing to the increased area of the borough; it was 1,000, now it is 3,000 acres.

10,825. You now take in a large agricultural population?—Yes.

10,826. (*Chairman.*) The death rate has been so reduced?—Yes; at the same time I do not know that comparing Halifax with towns of a similar area, Blackburn and other places, our death rate is favourable, it is much lower at the present time than theirs.

10,827. (*Mr. Harrison.*) In your own experience and practice you have found that the health of the town has improved?—Yes.

10,828. Have the sewers been constructed since you were in practice?—Yes, it was about the time when I came here, 10 years ago.

10,829. How was the sewage taken away before you came here?—It has always gone into the Beck ever since I came, the works were even then so far advanced as that.

10,830. Are there any cesspools now existing?—Very few, if any; I do not know of any.

10,831. Apart from the death rate, do you see an improvement in the health of the people?—Their diseases are not of so virulent a character generally as they were; it is many years since we had a very malignant attack of any of the more severe epidemics; we have had no cholera.

10,832. Have you observed any ill effects from want of ventilation in the sewers?—I have always thought of that.

10,833. Has anything come under your notice?—I have attributed the ill health of the inhabitants to bad air and want of ventilation.

10,834. Has that been in the upper parts of the town or the lower?—As much in the upper parts of the town as in the lower. The gases rise up and get into the houses. One means of ventilating the sewers has been by pipes, the water conductors have acted as ventilators, and this renders the effluvia liable, under certain circumstances, to get into houses.

10,835. Are the upper parts of the town inhabited by the wealthier classes?—By the better classes of the workpeople and the wealthier classes too.

10,836. The effect of an ill-ventilated system of sewerage is to remove the sources of disease from the lower parts of the town to the upper parts of the town?—Yes.

10,837. Is there anything further that you wish to add?—I do not know that I can say anything more. We have about 960 waterclosets, and about 11,500 houses inhabited, and the sewerage generally is, I think, in as perfect a condition as can be expected.

The witness withdrew.

J. E. Norris, Esq.

James Edward Norris, Esq. (Halifax), examined.

10,838. (*Chairman.*) You are town clerk of the borough of Halifax?—I am, and a native of Halifax.

10,839. You have known it from your boyhood?—Yes.

10,840. What length of time have you occupied the position of town clerk?—About $2\frac{3}{4}$ years.

10,841. What is the area of the borough of Halifax?—The area of the present borough is 3,768 acres. I have got an ordnance sheet here, which it might be useful to the Commissioners to refer to (*handing in the same*).

10,842. Has the area of the borough been recently extended?—Yes.

10,843. Since the charter of incorporation as a municipal borough?—Yes; I will briefly state to the Commissioners what our local government is. The town of Halifax is situated on the Hebble and Ovenden brooks, which are tributaries of the Calder. The borough is under the government of a council as a municipal corporation, and as a local board of health. The Public Health Act was applied to the borough in March, 1849, and confirmed by a supplemental Act in 1851. In 1848 a charter of incorporation was granted, and the powers of the local Commissioners, who acted under the Improvement Act, called the Halifax Improvement Act of 1823, were transferred to the corporation by a provisional order, on the application of the Public Health Act. I have here a copy of Mr. Ranger's report, which was made upon a preliminary inquiry previously to the issuing of the provisional order. I will also put in the provisional order itself, and the schedule to it, confirming it: portions of the Act of 1823 were repealed, and portions were made applicable to the extended area of the borough, the Act of 1823 only applying to the township of Halifax. When the Public Health Act was applied to the borough the drainage of the town was in a very imperfect state; in fact there was no system whatever of drainage. The town falling rapidly towards the Hebble, everything drained into the Hebble, and all the sewers that then existed emptied themselves into the Hebble; but a plan was obtained from Mr. Ranger for draining the town, which is shown by the red lines on this plan (*pointing to the same*). The main intercepting drain, which runs parallel with the Hebble, collected all the sewage of the area of the borough, and discharged it into the Hebble at a place near the "Atlas" Works at the southern boundary of the borough in 1853. The reason why the outfall was made at that point was because under the then existing Acts of Parliament Public Health Boards could not drain beyond the limits of their own district, but subsequent legislation has given them power to extend the area so that they may, if they choose, carry the sewage into other districts and utilize it, under the Act of 1865, for irrigation purposes. At the present time the outfall is at that point (*pointing to the plan*). In 1865 we obtained an Extension Act, by which the boundaries of the borough were extended, as you will see by this pink line. The old area of the borough was 1,220 acres; it is now 3,768. We have already commenced partially to drain the suburban districts, which have been recently taken in, and we have entered into one contract, which is to cost us, I believe, a sum of 3,000*l.* We have already commenced to prepare main arterial drains to include the more populous parts of the suburban districts, and we shall extend that system as the population increases. The original cost of the main drainage of Halifax was about 65,000*l.*; we had expended something like 66,000*l.*, a portion of that money was recovered from private individuals in the shape of payment for private improvements. We have expended now about 65,000*l.* for drainage purposes.

10,844. Is the present area of the municipal borough and the parliamentary borough coincident?—No; the parliamentary borough is coextensive with the old borough. If you recollect, under the Municipal Act there was power for the Queen to grant a charter of incorporation to the boroughs mentioned in the Reform Act, and that Act defined the boundaries. Of course you could afterwards, by subsequent application, apply to the Privy Council for an extension of the boundary by petition, but we preferred doing it by Act of Parliament; we wished to extend the operation of our local legislation to the whole area, a charter from the Queen would not have done that, it required Parliamentary enactment.

10,845. Then the Parliamentary borough is less than the municipal borough now?—Yes; the part coloured blue shows the old boundary.

10,846. Which is very unusual?—Yes, but we are a little in advance of the time.

10,847. (*Mr. Harrison.*) What does that circle

HALIFAX.

J. E. Norris, Esq.

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(*pointing to the plan*) represent?—The area of our water supply.

10,848. (*Chairman.*) Upon the area of 3,768 acres what is the population at present?—56,000 is our estimated population.

10,849. What was it at the last census?—The old borough, at the last census, contained about 37,000.

10,850. What was the population of the new borough in 1861?—I should think about 45,000; we now call it 56,000.

10,851. What is your rateable value?—165,000*l.* upon the extended boundary. I can give you a few figures to shew the rapid increase which has taken place in Halifax. In 1849, the annual rateable value in the borough, taking, say, the present Parliamentary limit, was 63,117*l.* 15*s.* 10*d.* In 1854, the rateable value was 77,414*l.* 3*s.* 4*d.*. In 1860. it was 108,177*l.* 4*s.* 0*d.* In 1864, 120,139*l.* 17*s.* 0*d.* In 1865 we went to Parliament for an extension of area, and the rateable value of the extended area was 158,208*l.* 6*s.* 8*d.* This year, at the present time, it has increased to 165,007*l.* 19*s.* 3*d.*

10,852. Is the borough still increasing in value rapidly?—Yes. I think we have had something like 300 plans sent in for houses, mills, and warehouses this year, but it has been a bad year for building, for everything has been dear; and last year I suppose we passed more than that probably.

10,853. You have now acquired the power of supplying the borough with water?—Yes. In 1853 we obtained an Act for the construction of waterworks.

10,854. Had none existed previously?—To a very limited extent. The town before 1853 was supplied from two springs, one called Birks Hall, and the other called Well Head.

10,855. Had any person a vested right in them?—No, they belonged to the commissioners of the town; they were transferred to the council when the powers of the previous commissioners were transferred to the council, but that was so insufficient a supply that the corporation went to Parliament in 1853 and obtained an Act to supply the town with water. This plan shows what that system is; the brown portion shows the township of Ovenden, and that portion (*pointing to the same*) is the valley of the Lud, the scheme embraced two sources. The Ogden scheme for the construction of a large reservoir with a capacity of 220,000,000 gallons, called the Mixenden Reservoir, and the Luddenden Valley scheme for the construction of a large compensation reservoir of 90 acres, and other service reservoirs. Thus there were two systems, which met at Ramsden Wood, and from Ramsden Wood the water is conducted first to the service reservoirs in the town, the Albert Reservoir and the Victoria Reservoir, and two other reservoirs called Hanson-lane, into which the water from Birks Hall was conveyed.

10,856. What is the surface area, the height of the embankment, and the capacities of each reservoir?—The drainage area of the Ogden district, which is now appropriated, is 1,220 acres.

10,857. Will you state the rainfall?—The Ogden Reservoir is capable of holding 220,000,000 gallons of water, and the deepest part is 66 feet.

10,858. What is the average rainfall?—36 inches would be the minimum, and 42 the maximum of that district.

10,859. (*Professor Way*). What is that blue line; is there a right to take water from the district or deliver it?—The area of supply is shown by that blue circle, and that blue circle is a distance of two miles from the extreme boundaries of the borough.

10,860. (*Chairman.*) Have you scheduled all those townships?—Yes, they are defined by our Act.

10,861. (*Professor Way.*) Has that any relation to the drainage area of the district?—No, not of the Hebble alone.

10,862. Have you a right to supply any part of the Huddersfield district?—No, we do not go there. The hills divide Halifax and the Calder from Huddersfield, but we can supply anywhere within that circle or within the townships which form an outer boundary beyond the circle.

10,863. (*Mr. Harrison.*) What is the radius of that circle?—I think it is six miles nearly.

10,864. (*Professor Way.*) If you deliver to all parts within that radius, will you be taking water from one valley into another?—I do not think it is physically possible to deliver water to all parts of the circle as some of the places are above the level of our supply reservoirs, but Parliament requires that Water Bills should state the area of supply. Within that area of supply there are no fewer than 12 local boards. We are at present supplying Sowerby Bridge; we are under a contract to supply the Elland district on the 1st of January, which is a place lower down on the opposite side of the Calder and has a local board. The Brighouse people are negociating terms with us to supply them with water and they have a local board. The Greetland people are also asking us for water, and in laying our pipes from Halifax to supply Brighouse we shall supply a large and populous district between Brighouse and the borough.

10,865. (*Mr. Harrison.*) Is the Ogden reservoir in the valley of the beck leading down to Halifax?—Yes, it is at the head of the Hebble valley.

10,866. Where are your reservoirs?—The existing works which we have now supplying the town are all in the Hebble district. We are now constructing new works in Luddenden valley; the Lud is also a tributary of the Calder. The cost of the productive works, including distribution, is 160,980*l.*, and we have already expended 64,357*l.* upon new works, making a total of 225,338*l.* in waterworks.

10,867. What do you contemplate expending before your works will be complete?—The entire scheme will cost us 300,000*l.*

10,868. What is your present income from the waterworks?—Our present income is 11,040*l.*; it was that last year; out of this we had to pay the cost of maintenance and interest of debt. For of course upon what we have expended in works yet incomplete and therefore unproductive, there is a present loss.

10,869. Do you levy a rate in aid?—No, we have other property the surplus profits of which go into the borough fund and we can pay the interest out of the borough fund without levying any rate in aid.

10,870. What volume of water do you supply annually from your works at present?—From our productive works in the Ogden and the Hebble districts about 1,250,000 gallons per day.

10,871. How much of that do you sell for trade purposes?—On the average 292,500 gallons a day.

10,872. At what price?—It varies according to the scale. I have a table which will show you the progressive state of our waterworks and income. The first column gives you the amount of expenditure on productive works, the second on unproductive works, the total income, the total amount of charge on productive works, exclusive of millowners' compensation, the amount paid to millowners for compensation, the interest on the net outlay for nonproductive works, the surplus on productive works, not including millowners' compensation, and so on, the net surplus, the net deficiency, the average quantity of water daily supplied, the quantities supplied for trade purposes and the quota supplied for domestic purposes. We have analyzed our trade sales in this way. Dyers and scourers, woolwashers, and supply for steam boilers, Local Boards in the district, and sundries, such as water supplied for small machines for moving-printing presses.

10,873. Is your water used for power in small establishments to any extent?—Yes; 34 per cent. of the water that is sold for trade purposes is used to generate steam.

10,874. Or for water power?—No, not for water power.

10,875. (*Chairman.*) You have no dolphins or things of that kind?—No, nothing of the kind; the water goes through our meters.

10,876. (*Professor Way.*) Do you not supply for lathes?—I know of two small machines in town that are used for turning printing machines. The accountant says that there are about half a dozen small

water power engines that are worked by the pressure of water. As to the percentage, dyers and scourers take about 21 per cent. upon the whole of our consumption, woolwashers 12½ per cent., steam boilers 34 per cent., Sowerby Bridge Local Board 21½ per cent., and about 19½ per cent. is used for sundry purposes; that is the return for 1866. One thing is very striking in this table. If you refer to this table you will find that when we had plenty of spare water for sale the percentages of certain trades were considerably larger than now. In 1861 when our works were in full operation dyers and scourers were using 72 per cent. of all the water, woolwashers were using 10 per cent., and steam boilers only 14 per cent. Now gradually the small manufacturers who have steam-engines are taking the water through meters for steam condensing purposes and those who usually used water in great quantities in bulk cannot now have it; we have to restrict them until the new works come into operation, so that there is a gradual falling off in the using of large quantities of water in bulk and a gradual increase in the consumption by meter. I will hand this table in (*handing in the same.*)

10,877. (*Chairman.*) What will be your entire daily volume when the works are completed?—From the Ogden and Hebble districts and from the Luddenden district when they are completed, our daily quantity, after giving compensation to the millowners, will be 3,700,000 gallons a day.

10,878. Will that be the total volume you will have at command?—Yes.

10,879. Do you know what quantity of water you give for compensation?—Yes; we have to discharge down the valley of the Hebble under the provisions of the Halifax Improvement Act of 1853 3⅔ cubic feet of water per second during 12 hours of every working day, about 950,000 gallons, omitting Sundays. Then in the Luddenden Valley the quantity of water given for compensation, including some reservoirs on the Warley Moor will altogether be 5⅓ cubic feet.

10,880. In gallons per day how much will that make for compensation?—About 2,000,000.

10,881. You use 3,700,000 gallons and you pay 2,000,000 in compensation?—That will be the state of things when the system is completed.

10,882. Having paid that compensation have you such uncontrolled command of the area that you could add to your reservoir room at any period?—Not without special parliamentary powers.

10,883. You do not obtain the entire use of the district upon paying that stipulated compensation?—No, we were limited specially to the area shown on the plans, and we could not take our catchwater drain any further than a given point.

10,884. What was the name of the reservoir that I visited?—That was the Ogden reservoir.

10,885. Supposing that you wanted to raise that reservoir five or six feet so as to obtain 50,000,000 of gallons more water, you could not do it without special arrangement?—Yes, we could raise the embankment, no doubt but we should not have sufficient catchment area. I am now speaking from the evidence we have received from Mr. Bateman.

10,886. Have you such control over your area that if nature will allow you to extend your reservoirs you can do it without increasing your compensation?—You cannot raise your levels above a given height according to the standing orders.

10,887. Could you not make a second reservoir at the foot of it?—Not unless we acquired the land.

10,888. If you acquired the land could you then make a second reservoir?—I think we could but we should have to pay compensation to the millowners.

10,889. You have not sought for nor obtained an uncontrolled right by paying a fixed sum?—No, we were anxious to get it in 1865, but we were opposed by the millowners.

10,890. If you increase the volume for use in Halifax you must treat with the millowners?—Yes, undoubtedly, the more gathering ground we appropriate the more compensation they require in return. In 1864 and 1865 we were obliged to limit the trade and curtail the domestic supply.

10,891 (*Professor Way.*) Did you raise the price of the water?—Yes, last year on our trade sales, but not for domestic consumption.

10,892. (*Mr. Harrison.*) What is the population within the circle you supply?—We estimate it at present at 92,000.

10,893. Independently of the borough?—Including the borough, that is the population that we estimate we could supply from our system of waterworks; of course it is increasing rapidly.

10,894. (*Chairman.*) If the population which you had power to supply amounted to 100,000 and you supplied them with 20 gallons per head, that would consume 2,000,000 of gallons of your water, and you would have left for trade purposes 1,700,000 gallons when the arrangements are completed?—Yes, which is certainly too small. We have the uncontrolled use of the area within which water is now collected, but I do not think we could appropriate any other portion without further parliamentary powers, and we therefore must go to Parliament for an extension of our water supply.

10,895. Both in Liverpool and in Manchester they have been driven to the expedient of buying off in money the compensation in water which they were bound to give by Parliament?—We wished to have a similar clause put into our bill in 1865 but we were strongly opposed by the millowners, we only asked for permissive power to treat with the millowners.

10,896. Your Act of Parliament defines the conditions you are placed under with regard to any better supply in dry seasons?—Yes. If we do not send down the stipulated quantity we are bound to pay a penalty of 10*l.* a day to every occupier of the stream.

10,897. Has that penalty yet been inflicted upon you?—Yes, in 1862, which was the first year, we paid 902*l.* 17*s.* 3*d.*, in 1864 we paid 179*l.* 5*s.*, and in 1865 when we went to Parliament we paid 4,373*l.* 4*s.* 6*d.*

10,898. It is of the utmost importance that the authorities in the borough should be in a position to avoid these heavy fines?—Undoubtedly. I consider that the welfare of Halifax depends upon our having an unlimited supply of water.

10,899. (*Mr. Harrison.*) Have you had a valuation made of the mill-power to which you now give compensation?—Yes, I have a table here which I will hand in which probably may give you an approximate idea. The penalty is not solely for water-power mills, the words are "to all occupiers of mills and other works on the Hebble," so that every man who draws a few gallons of water for condensing or washing purposes; even a basket-maker, if he knows we are not sending down the full quantity, can claim 10*l.* a day just the same as the largest manufacturer. This is a Table showing the number of mills upon the Hebble and Ovenden brook from Salter Hebble upwards to the head of the valleys. There are altogether 40 mills on the Hebble and 10 on the Ovenden Brook, making a total of 50 mills. The total annual value of those within the borough is 32,324*l.*, and of those beyond about 6,000*l.* It gives the names of the occupiers, the trade or manufacture, and the stream from which they take their supply, it is more or less also a list of those mills which draw from the canal which is fed from the Hebble. There is also a column showing the average daily consumption of water taken from the corporation for trade purposes, and that which goes through a meter into their premises is discharged either into the river or into a sewer.

10,900. Are you under any obligation to supply the canal with water?—None. The canal proprietors have parliamentary power to take water from the Hebble. The total average daily consumption of water through meters at those mills on the stream is 91,830 gallons, but it is a very small figure. In 1862 I think it would have been something like 200,000 gallons a day.

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10,901. (*Chairman.*) Under your present system of sewerage the sewers empty themselves as you have stated at the edge of the boundary of the old borough?—Yes.

10,902. Does the sewage cause any nuisance there?—Yes, undoubtedly; the most poisonous.

10,903. Has it been complained of by any residents near to it, or millowners below?—No, we have never had any formal complaints.

10,904. I suppose that this source of nuisance is mixed up with other nuisances?—Just so; the river is much polluted above that outlet from different causes.

10,905. If you extend the use of waterclosets beyond the borough and allow that existing outlet to continue the pollution will be largely added to?—Undoubtedly.

10,906. It might become so serious as to make you liable to an indictment?—Yes, no doubt of it.

10,907. Have you (since you have been Town Clerk) discussed the question as to the propriety of carrying away the sewage?—Yes; our engineer was instructed at the beginning of the year to report as to the mode of dealing with the outfall sewage of the town, and he no doubt by this time would have made his report upon it, but he found that you would be coming here and has, no doubt, delayed it until he should know what the result of this commission would be.

10,908. Does a great portion of the drains go into a beck called the Red beck?—Yes; a portion of the drainage area of the borough falls towards it.

10,909. Is there any pollution of any serious consequence there?—Nothing particular, but there is a circumstance connected with the proposed drainage of that district which is worth mentioning to you just to show what difficulties may arise when you wish to get rid of the sewage even for irrigation. We proposed to make a main drain to carry off the Charlestown drainage towards the beck, and we received notice from Mr. Lister, a large landowner and others, that if we attempted to drain into the Red beck they would apply to the Court of Chancery for an injunction. We then suggested that Mr. Lister being a large landowner should take this sewage and apply it for irrigating purposes on his land but he declined to listen to the proposal, saying that his land was park land and not meadow land. We are therefore now in this dilemma that we have no outfall on that side of the hill, and we do not know in what position we may be placed,—we may have actions and injunctions coming against us on all sides.

10,910. What is the state of the law with regard to these nuisances as to prosecutions and indictments?—It is in a most unsatisfactory state: in fact we are at the mercy of anybody who can complain of our acts as being nuisances and injurious to health, and we can compel nobody to refrain from throwing their refuse and drainage into the brooks. We are in that position that we may be indicted for a nuisance or have an injunction obtained against us.

10,911. As a municipal corporation you are entrusted with the good government of the borough?—Yes.

10,912. A part of that good government consists in improving the health of the borough?—Yes.

10,913. If making good sewers and drains would tend to that end you would I presume conceive it your duty to make them?—Yes, undoubtedly.

10,914. As the law has provided you with no efficient means of getting rid of the refuse it is passed into the nearest watercourse is it not?—Yes.

10,915. Then you are open to proceedings from the landowners on the river below you for fouling the river?—Yes.

10,916. Therefore as the law stands you are liable to be sued for having effected a purpose which you were appointed to carry out?—Yes, that is the state of the law now.

10,917. I suppose you would wish, if it were practicable, that parliament should examine into this question either through the present commission or in any other way and, if possible, provide you with some more efficient means of dealing with nuisances which result from improving the health of your district?—We cannot carry out a proper sanitary system unless we have some parliamentary protection and means shown to us by which we can get rid of this outfall.

10,918. How many houses are there in the borough? About 11,000.

10,919. How many waterclosets are there?—960.

10,920. What number of ashpits and middens are there?—I do not know. The inspector of nuisances will tell you. I have a Table here which shows what we have expended in cleaning out ashpits and the charge upon the rates in each year from 1854 down to 1866 (*handing in the same*). I cannot give you the number of ashpits, but we paid last year 342*l.* for cleansing them, and we received 241*l.* 9*s.* 6*d.* from occupiers for the service.

10,921. That was a loss of 100*l.* 10*s.* 6*d.*?—Yes, which was chargeable to the rates.

10,922. Do you levy a charge upon owners for cleansing their ashpits?—Yes; we charge them according to the quantity of stuff removed.

10,923. Can they remove it themselves?—Yes, they can.

10,924. Do they remove it?—Those who remove it themselves are more connected with the agricultural and suburban districts; the farmers fetch it. If it remains and becomes a nuisance our inspector gives them notice to remove it, and if it is not done then we can do it, and charge the owners with the cost under the Public Health Act.

10,925. Is not all the refuse from ashpits and privies, as in Manchester and Liverpool, vested in the corporation?—No.

10,926. In those two boroughs and some others the whole of the refuse is vested in the corporation?—Yes, and that would answer in a very populous district, a city or town, but not here.

10,927. You act through the inspector of nuisances, and you can indict a person or clear away the refuse for him?—Yes, and charge him the cost of the work; that which is taken away by our own carts becomes the property of the corporation. Several gentlemen will come before you who will describe to you the state of their works and the state of the river caused by refuse of manufactories falling into it. I have not yet given you the storage of the reservoirs. The total capacity of our service reservoirs is 58,688,564 gallons exclusive of the Ogden Reservoir, which holds 220,000,000 of gallons, that being partially a compensation and partially a town reservoir. The total area of the gathering ground is about 1,240 acres. I will put in the Act of 1853 and also the Act of 1865 (*handing in the same.*)

10,928. Have you formed any opinion as to the sources from which water should, not be taken?—Yes.

10,929. You are aware that some towns in the district have been obliged to take water from the polluted river?—Yes; and I think it is very desirable that there should be a general measure passed for the purpose of placing the management of the rivers—say within the basin of the Calder—under the supervision of a conservancy board. Such a conservancy board should be represented by the various local bodies and water companies as well as corporations within the basin.

10,930. Would you have them constituted as an elective body?—An elective body. My opinion is that no town ought to be allowed to draw its water supply from the Calder proper for town purposes, and that the scheme would pay if all the property within the area of the Calder were to be taxed in order to buy up such water companies as now draw from the Calder. I have a table here giving the number of parishes in the basin of the Calder, the area and the rateable value. There are 13 parishes, and the total area is 151,149 acres, while the rateable value is 1,214,283*l.*

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10,931. Do you think that would be a proper area from which to elect a conservancy board?—I think so. I would also suggest that if a general measure is passed to prevent refuse being thrown into these tributaries or rivers, and particularly tributaries, from towns and manufactories, each town should be compelled to send into the board of conservancy a plan of its proposed drainage, or its mode of dealing with the outfall or any sewage irrigation works. Then that the conservancy board should approve of that plan and submit it to the Home Secretary through the Local Government Act Office, for confirmation by a supplemental Act. It is very important that all towns should be placed in a position of security for the immense amount of money that they must lay out in these works; therefore I think that any plan which might be approved by the conservancy board should receive the sanction of Parliament.

10,932. In a similar way to a provisional order which now receives confirmation by being entrusted to the Home Secretary to lay before Parliament and carry it through?—Yes; I think that any plan proposed and sent to a conservancy board should be afterwards sent to the Home Secretary for confirmation; notice would be given, and parties who were interested and who might feel injured or affected by the proposed works would then have an opportunity of appearing before the committee to which such plan might be referred and of asking for clauses.

10,933. The proceeding would be something like an application for town or street improvements, they would schedule the property and serve notices as for a private Act and deposit the necessary documents with the clerks of the peace?—Or with the Town Clerk.

10,934. You send duplicates to the Home Office?—Yes.

10,935. A local inquiry is directed?—Yes.

10,936. And a report is made?—Yes.

10,937. Then a schedule is prepared and a provisional order is made?—Yes.

10,938. If that provisional order is not opposed it passes Parliament, as a matter of course, without any expense to the locality?—Yes.

10,939. If it is opposed it is sent to a select committee and must take its chance?—Yes. I think it would be very proper machinery to adopt for anything that may be done in dealing with rate-payers' money in these localities for drainage purposes.

10,940. At the present time I daresay you know that the law makes no provision for your going to Parliament?—None.

10,941. If you go as a corporation to Parliament, you go at your own risks and charges?—Yes.

10,942. Do you think that any arrangement can be made or security given that a scheme is *bonâ fide*, because there are reasons why that power has not been granted to corporations?—I think it is more from want of legislation than from any inherent drawback in applications of corporate bodies. Corporations are trustees for the district and of the ratepayers' money; it is not to be supposed that they will go to Parliament wantonly. I think that where an application has to be made by a corporation for towns purposes, they ought to be protected if they do not succeed.

10,943. Do you think it could be done in this way, that the Secretary of State for Home Affairs, or the Board of Trade, if a dispute arose between the body of ratepayers, and the municipal body should decide the matter, and that the party should not have the option of going to the Court of Chancery?—I think that that would be a very wholesome provision. I may mention an instance. In 1864 I advised the corporation, when going to Parliament for an extension bill, that they could not appropriate their funds for the purpose. Two gentlemen in the council then made themselves personally responsible to the bank for 5,000*l.* to cover the costs, on the risk of our getting our bill.

10,944. Do you think that is a right state of the law?—No, I think it is very unjust that it should be so, and applying your suggestions as to the dealing with the public drainage or any expenditure for a large town, it is very important, I think, that the cost of applications to Parliament should not be questioned after receiving the approval of some authorized Officer of State. Town clerks do communicate with each other, and to a certain extent there is united action, but there is very great difficulty in getting the heads of departments to take a case up; they say that it will form the subject of a General Act shortly; there are two or three things that we have been trying to get done. As to legalising bye-laws which are a sort of local Act of Parliament without the sanction of Parliament, any person can question the validity of those bye-laws if he thinks that they are repugnant to the common law or the statute law. We wanted the Home Secretary to pass an Amendment Act by which the bye-laws, after receiving his sanction, shall be considered as law, until they are brought to the Court of Queen's Bench and quashed on *certiorari*. It was considered a very desirable thing to be done, and we had a short bill prepared, but it was put on the shelf and we have heard nothing of it now for two years; we were told that the thing would have to be dealt with in a general measure. I think that in any general measure with respect to these rivers besides preventing traders and manufacturers from throwing refuse into them, there ought to be a stringent law to compel canal companies to cleanse out their canals also, and again, where rivers are navigable, the companies who enjoy the navigation should be charged with the dredging.

10,945. Do you not think that at present, parties engaged upon canals, navigations, and rivers, are compelled in self-defence, in order to carry on their own trade, to cleanse and dredge them?—Canals I think, are going back; they are not so flourishing as they were, and the undertakers are liable to neglect these things and allow the canals to become like duck-ponds instead of canals. I think it is necessary that something should be done so long as they remain canals; they ought not to be allowed to be nuisances; let people either keep them clean or abandon them.

10,946. (*Professor Way.*) Are not canals generally supplied with water from rivers?—Ours is supplied from the Hebble, so that our sewage water is pumped back into the town.

10,947. Would not the proprietors of the canals say that the filthy state of the river caused the canal to be in so unclean a state?—Yes, and they do say so; but still, according to the common law, they must not act so as to increase the nuisance.

10,948. (*Mr. Harrison.*) If steps are taken to purify the Hebble, and if, consequently, at the place whence they draw their supply the water is purified, will there then remain any objection to thus drawing water from the former source?—Not at all, if you get rid of the cause of the nuisance.

10,949. I see in the return you have handed in, that the amount paid for cleansing ashpits has increased considerably since 1852, how do you account for that?—In this way. We only became a local body under the Public Health Act in 1851, and our surveillance has been increasing. The increased amount is indicative of better supervision.

10,950. You have stated that there are only 960 waterclosets in the whole town?—Yes, at the present time, which are paying to us.

10,951. Are ashpits very common in the borough?—Yes, they are.

10,952. Do you intend to perpetuate them, or do you contemplate the extension of the watercloset system in the poorer dwellings?—At the present time the corporation being short of water do not encourage the watercloset system and will not do so till the new works come into operation, but we are very stringent in our byelaws as to the construction of ashpits and privies. I think among the cottage owners there is rather an objection to waterclosets because they are more liable to get out of order and become a nuisance

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than ashpits and privies, which are under a system of periodical cleansing. We have about 3,000 ashpits and sometimes a nest of privies empty into one common ashpit.

10,953. Have you experienced any beneficial effects from your water system as to fires in the town of Halifax?—Yes, we have fireplugs all over the town, and when a fire occurs we have simply to apply a hose.

10,954. Have you been able to extinguish a fire more rapidly?—Yes, the labour of working the engine under the old system was very great.

10,955. Has the saving of property been considerable?—Yes, we receive periodical reports from the superintendent of police showing the amount of property destroyed and the amount of property saved.

10,956. Have you had any estimate made of the value of the water power or the compensation you would have to make if the owners of watermills substituted steam power for their water power?—We have not had a valuation made. There is no doubt that in this town where coal is so easily procured of all kinds and for such large concerns as those which exist on these streams water power is of very little value. The total available fall on the Hebble is about 405 feet; that is from Bottom's Mill down to Salter Hebble.

10,957. From your experience in the sale of mills, what do you value that water power at per annum?—About 5*l.* per horse power is the rateable value of the appropriated falls.

10,958. Do you think that it could be bought up at that sum?—I do not know. I am afraid that our heavy penalty of 10*l.* a day is rather a bonus than otherwise, and that the parties would not like to part with their power; at least some of them might not, but I think that the majority of the mill-owners would act liberally in the matter, however we have not attempted it.

10,959. It is a question whether it might not be worth while to buy up all the water power in these valleys instead of going to a distance for further waterworks?—I think as a precaution we ought not to decrease the volume of water that comes down, even supposing we could send down that quantity for flushing and general sanitary purposes alone. It would be very desirable to form impounding reservoirs at the heads of all valleys so as to send down a greater quantity in dry seasons for flushing the streams.

10,960. What is the area of the Hebble?—I think the watershed of the Hebble is about 5,600 acres, of which 1,240 are now appropriated for the Ogden reservoir, and when the Mixenden reservoir is made we shall take 190 acres more.

10,961. What part of that area is above the town of Halifax?—The watershed above Lee bridge is 6218 acres, that is including the Ovenden valley.

10,962. You stated it would be desirable to prevent towns upon the Calder taking their water supply from the Calder proper?—Yes.

10,963. Would you apply that to the town of Wakefield?—Yes.

10,964. If you prevented them from taking water from the Calder, how would you make compensation?—I think that the whole of the basin of the Calder should be taxed for the purpose of buying up the pumping works at Wakefield. It is most desirable that Wakefield should be debarred from taking water out of the main drain of this district for its supply. I would tax the whole of the area of the basin of the Calder for the purpose of buying up those works.

10,965. Then they would have to go to another expensive source?—Yes, but you may be compelling us in the upper parts of the river to cease polluting the streams, and you may be putting us to expense in carting away the refuse which we now drain into those streams, and if we increase the volume of water to Wakefield and those who are below, I do not see why they should not be put in the same category and be made to seek water from other sources where they can get it pure. I consider that at Durnford bridge, from which point Dewsbury is supplied, they might lay a pipe on to Wakefield. I believe there is sufficient catchment to supply Wakefield, Dewsbury, and Mirfield.

10,966. How could Wakefield, taking water from the Calder, affect towns situated below Wakefield?—So long as there are existing rights above Wakefield, which you cannot possibly prevent, there must be a certain amount of pollution coming down the river—there is no doubt that from manufactories and other sources — from places with a large population like Wakefield—there must be some nuisance; I therefore think it most desirable that for their own sakes you should prevent the people below Wakefield from taking water out of the river.

10,967. And you think it would be fair to tax the whole basin. How far would you extend that?—Over the whole basin. I consider that the people living below Wakefield will be benefited by any general measure that may be proposed for the purification of the river in the same way as those above Wakefield will be; there will be one system which will be as fair to those above as to those below Wakefield.

10,968. (*Chairman.*) Would you base the taxation on the Poor Law valuation?—Yes; and borrow the money from the Loan Commissioners at 3¼ per cent., and extend repayment over a period of 30 or 40 years. I would collect it in the shape of a county rate as the poor rate is collected.

10,969. Is the county rate now paid out of the poor rate?—It is collected with it, and paid by the overseers of the poor.

10,970. An estimate is made, and the two are collected as one rate, and the amount required by the magistrate is paid out?—Yes.

10,971. And you would do the same thing with a rate for the prevention of river pollution?—Yes. I would adopt the same machinery. The rateable value of the whole of the basin of the Calder being say 1,250,000*l.*, the payment of say 50,000*l.* to buy up the Wakefield pumping works, would be a fraction of a farthing in the £ extended over 30 years.

10,972. (*Professor Way.*) Is not the acquisition of water power by companies to some extent a limit to the increase of population in the districts from which the water is taken?—No; I think not. If you take water from high sources, or from sources where it is totally unpolluted, and it comes down to those districts pure, you do not at all injure the district from which you take it.

10,973. You do not injure it as it exists, but when water from one district is taken to another, will it be possible for the supplying district to grow as it might otherwise have done?—The water is taken from a high uninhabited district.

10,974. If you rob one valley of water to benefit another, you might prevent the development of the first valley in its lower parts?—Yes.

10,975. You have stated that water is very much sought for in Halifax for manufacturing purposes?—Yes.

10,976. And that as population grew you found it impossible to supply the wants of trade to the same extent as before because more water was wanted for domestic purposes?—Yes.

10,977. Increase of population I suppose is dependent upon increase of trade?—Yes.

10,978. Will there not therefore come a time when increase of population will be checked if you diminish the supply of water for trade purposes?—To a certain extent that must be the case, but still if you take water from a high level I do not see why you should not impound it at the heads of the valleys included within the area of the supply, and so provide for the wants of the populations in those valleys.

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10,979. Compensation is always estimated in reference to existing trade, is it not—arrangements for the future are not contemplated ?—No ; compensation is based on the minimum quantity of water passing down the valley from which you are seeking to carry it away.

10,980. The question is whether you should encourage the practice of taking water from the highest sources, if you are indifferent to the state of its purity after you have used it, and as it passes away from you through your drain. The Wakefield people now take water from the Calder, and if any remedy for the pollution of rivers could be devised, they would probably have purer water than they have now ?—Of course they would to a certain extent, but still the water of the Calder would be in a very unfit state for their consumption.

10,981. If you extend your collection of water to the highest sources you may be doing that which might not be necessary if the river could be kept clean ?—I do not think it is possible in manufacturing districts so to purify the water in rivers as to make it fit for town supply—that is for drinking purposes. Of course I do not know what chemistry may do. If you can purify sewage so as to make it fit for the public to use it, then I think the problem will be solved ; but if you cannot do that, then I do not think it will be possible to purify the waters of rivers so as to make them fit for use or safe.

10,982. I suppose you know that a large bulk of the water required for manufacturing purposes is used for washing, and that if water is moderately pure and free from sediment it can be used ?—Yes.

10,983. Is it not possible that by proper measures the water which comes from the ordinary streams of this district and others also may after use at manufactories be rendered sufficiently pure at the manufactories before it is allowed to leave them ?—Yes ; if you could keep out solid refuse and compel a system of filtration in the manufactories, then you might send the water comparatively pure into the stream and make it available for many purposes, such as washing, but such a law must be general and must apply to the whole country. It will not do to put a certain manufacturing district under restrictions and allow another district to act with impunity under the old system.

10,984. (*Chairman.*) Parliament has thought fit to grant Waterworks Acts in different parts of the country as in the case of Liverpool, which obtains its supply from Rivington, which is in another part of Lancashire, 36 miles away, and the growth of manufacturers has been so great about Blackburn that since the cessation of the cotton famine there has positively been a water famine. Mills are shut up and hands thrown out of employment. Do you think, if it could be shown in the case of Blackburn that a much better supply could be obtained from another district, it would be right and proper that that district should be deprived of water which is required for its own mill hands ?—That takes me back to my original position, that you may go into a water yielding district to the highest ground you can reach, and if the water is so abundant that you can impound it without doing any material injury to the persons living below you may so impound a great volume of pure water which would otherwise run away into the ocean; and serve both districts.

10,985. Do you think that Parliament would be better able to deal with these great questions if the country were divided into drainage areas and Conservancy Boards were established to take charge of those areas, and to study the question generally and also in its details ?—Yes.

10,986. So that when any fractional portion of an area was dealt with it should always be dealt with in reference to the whole area ?—All these valleys have their own specialities. I think that you must put large basins under Conservancy Boards, and those boards ought to study these subjects, as to dividing the country into districts for water supply, &c.

10,987. Are you of opinion that much mischief might be avoided if the control and management of a large area were placed in the hands of a properly constituted body ?—Yes ; that would be the object of a Conservancy Board.

10,988. Do you think that a large waste of money might be prevented ?—No doubt of it.

10,989. If the law were modified, great and useless expenditures, parliamentary contests, and local struggles might be avoided ?—No doubt of it. If the contemplated body had the power to give its approval to any scheme affecting the water supply of a particular basin, I think that all parties might be satisfied.

10,990. You would have a disinterested tribunal who would exercise an impartial judgment and whose opinion, if a question was referred to a select committee of the House of Commons, would have considerable weight with the members of that committee ?—Just so.

10,991. You have no doubt that such a system would prevent a wasteful expenditure of money ?—I believe it would have a very beneficial effect, but you could not get rid of difficulties altogether.

The witness withdrew.

JOHN CROSSLEY, Esq. (Halifax), examined.

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10,992. (*Chairman.*) How long have you been resident in the town ?—I am a native of the place and so was my father before me.

10,993. Have you any statistics that would show the growth of trade in the valley of the Hebble ?—I can only say that the growth since my boyhood has been immense on all sides.

10,994. Do you think it has attained to the utmost limit that it is likely to ?—No, the trade is still growing.

10,995. And may grow to an extent that you would not venture to predict ?—Yes.

10,996. Does the growth of trade depend in any degree upon the water of the valley ?—It immensely depends upon the water. The trade of this town I have no hesitation in saying has been very much restricted and curtailed by the want of a large volume of water.

10,997. The growth of the trade of this district depends in a considerable degree upon the volume and purity of the water ?—Yes, purity also is a very important element indeed.

10,998. There are, I believe, two sources of supply, that which is impounded from surface drainage, and that which is derived from the strata by pumps and wells ?—Yes, and springs ; there are a number of springs which are scarcely ever dry, and which have been secured by the corporation.

10,999. Is coal worked to any extent in this valley ?—Very slightly indeed ; the bed of coal is very thin ; there is in the Ovenden valley a coal pit, and only one that I know of.

11,000. Where is the coal brought from ?—Principally from the Barnsley district, from the Normanton and the Wakefield districts and Brighouse.

11,001. You have a coal field adjoining, but the town is not situated upon it ?—No, it is the Halifax bed, but a very thin one; recently it has not been worked, I mean since railways and other kinds of communication have brought in coals from more distant parts.

11,002. Does the firm of which you are a member possess more than one mill ?—We have a number adjoining each other.

11,003. Where are they situated ?—In the borough at a place called Dane Clough.

11,004. On the banks of the Hebble or near what stream ?—They are on the banks of the Hebble.

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11,005. Do you use the water of the Hebble for power of any kind?—The original mill belonging to my father was exclusively a water-power mill.

11,006. Have you that mill still?—Yes, the water-wheel is still there of about 10-horse power.

11,007. What extent of steam power have you added to it?—We have added very largely indeed to it. I think there are six or seven engines each nominally of 60-horse power.

11,008. What amount of coal do you consume per annum?—About 27,000 tons.

11,009. Do you know what weight of ashes those coals produce?—The weight of ashes and other refuse material which are carted away is about 1,400 tons per annum.

11,010. What do you do with the other ashes?—All of them are carted away.

11,011. Your ashes would be about 5,000 or 6,000 tons I suppose?—Yes; I must be in error.

11,012. Would the ashes be one-fourth or one-fifth of the whole quantity of coal?—Yes, they are very considerable, it requires many carts to take them away.

11,013. (*Professor Way.*) Would the ashes be about 12 per cent. of the coal?—That would be very much nearer the mark; we have a great deal of rubbish and refuse.

11,014. You do not pollute the stream or obstruct it with your ashes?—We have been very careful about that. Many years ago we were, I may say, guilty in that matter; we put our refuse almost exclusively into the beck, and it was washed away, that lasted for a number of years, but we do not put any in now.

11,015. You cart it away?—Yes.

11,016. Have you the means of disposing of it, or is it a cost to you to cart it away?—Yes, it is a very considerable cost to us; we have been obliged to get space wherever we could; we have sometimes had to cart the rubbish two or three miles, but latterly we have met with some spare ground not very distant, and we have conveyed it there.

11,017. You make a spoil heap of it I suppose?—Yes; formerly we used to let the soapsuds go into the river.

11,018. At what cost per ton is the rubbish taken away?—To Leeds it costs us I think 1*s.* 6*d.*, or something like that.

11,019. What number of hands do you employ?—Of men, women, and children at Halifax, about 4,300.

11,020. What arrangement have you for privies?—We think we have a very perfect arrangement.

11,021. Do you pollute the river in that respect?—Not in the slightest degree. Take our sheds, for instance, we have a sort of long passage under a shed on which the soil is deposited, and during the night it is conveyed away by tramway to the extreme end of the shed for deposit in a tank, and from that it is carted away on to the land.

11,022. Land of your own?—Yes; and we sell a great deal of it; we turn it to account.

11,023. You can carry on your great works with your numerous hands without polluting the stream which flows past you?—Yes, we have not so polluted it for many years in the slightest degree.

11,024. What volume of water do you use on your premises?—What we raise by pumping ourselves from wells which we have sunk and drift ways which we have made (we have bored in all directions), what we pump from the river itself, and what we take from the corporation will altogether amount to something like 1,000,000 gallons a day.

11,025. In 24 hours?—Yes, for all uses.

11,026. How much of that do you take from the corporation?—At present they have restricted us; the fact is, we have not been able to get what we wanted.

11,027. If they could sell you more you would take more?—Yes; latterly we have not had more than about 8,000 gallons a day, but we have taken as much as 80,000 gallons a day.

11,028. For what purpose is that used?—For washing, or for dyeing, or printing.

11,029. Is that water pure and soft?—It is very nice and good water, excellent water.

11,030. About what volume do you raise from the river per day?—I have not got the particulars, but we raise a very considerable quantity; we also wash yarns with it. We use an immense quantity for that purpose, and the waste water is immediately discharged down the river in not a very much worse state than it was when it came to us. We must have a certain quantity to get the requisite purity.

11,031. Is the river water at any time objectionable?—We could not use what comes from the Ovenden stream at all; we take water from the Whitley stream, our works are just at the junction of the two.

11,032. Are there works situated upon those streams above you?—Yes.

11,033. Do they pollute the waters before they come down to you?—The water of the Ovenden brook is polluted to such an extent that it is perfectly useless to us.

11,034. If restrictions were put upon these manufacturers (assuming that it is found that they can carry on their trade beneficially without polluting these streams) would those restrictions be a benefit to you as a manufacturer?—Yes, a very great benefit.

11,035. Would you consent to be put under similar restrictions requiring you to send your water down to your neighbours as pure as you received it?—We should be glad to be shown the art and mystery of doing that.

11,036. If science can point out any means by which you can purify the water and yet carry on your trade without serious loss you would be glad to do so?—We should be delighted to do it.

11,037. Are there attached to the mills above you private reservoirs, or impounding reservoirs?—Yes, there are several.

11,038. Are there any attached to your mills?—We have had one.

11,039. What volume of water will it contain?—We have now covered it over with a shed, and it is very much circumscribed; it was a very large one formerly, I cannot say what size it is.

11,040. When any of those mill reservoirs become choked with sediment, which I assume they do, what is done?—In a time like this the owners would open their sluices and set a number of men to work to get rid of that deposit and flush it into the river.

11,041. Supposing that floods do not occur, do they ever flush out their reservoirs at other times?—Sometimes they do, to the great grief and annoyance and injury of the parties lower down.

11,042. Do you do a little flushing in your own reservoir?—We have done such a thing, but I think we avoid it; I am quite sure that we do.

11,043. You strive to do what you can?—Yes.

11,044. You are subject to pollutions which are caused by the flushings above?—Yes.

11,045. Formerly you did flush your own tank into the river?—Yes; but latterly we never do so unless in a very extreme time like the present, when our neighbours would not be injured.

11,046. Suppose this state of things, which will apply to many rivers. Say that a river is five miles long, and that there are 10 mills upon it, each of them having an impound reservoir attached to the mill, and each of them accumulating refuse. As the law at present stands, or rather as the practice is, the upper mill owner flushes his reservoir and sends the mud into the stream; the second catches a portion of it, and the third, the fourth and fifth, and so on, each in his turn does the same thing, each of them in flushing his own reservoir is benefited for the time being, and injures all his neighbours below?—Yes, that is really the case.

11,047. Does it not appear to you that if each of those individuals was compelled by law to dispose of what mud came to him in some other way than by passing it into the river it would be a benefit to all,

because although the first cost might be something considerable, each would derive an advantage by having less mud to deal with?—We should be very glad if such a plan of proceedings was enforced by law; however inconvenient it might be, we should be delighted to have it carried out.

11,048. Supposing that by your own arrangements you prevent pollution from watercloset, and also pollution by ashes, you would be also desirous of preventing pollution by accumulations of mud?—Yes.

11,049. Do you think that your good example would be so powerful, that all your neighbours above and below you would follow it?—I cannot say.

11,050. I am sure that you are aware that the example is not followed?—I know that it is not.

11,051. Can you state what volume of water you pump, and the cost of it?—I should say that nearly all or a very large portion of the water which is pumped up to be conveyed to pipes in our works, is afterwards used for washing and other purposes; but a great part of the entire water consumed, will be used for condensing purposes, and that is taken from the river direct to our engines.

11,052. What is the material that you use principally in your works?—Wool, cotton, and linen.

11,053. Can you state what is the annual weight of the three kinds of material that you use?—Our consumption of wool is close upon 400 packs a week, a pack weighing 240 lbs.

11,054. What weight of soap do you use?—Very large quantities. I cannot give you the precise quantities.

11,055. What becomes of the refuse water after the materials are washed?—I must draw a distinction between the washing of wool and the washing of pieces; when we wash wool we use soap, and latterly we have extracted the soap again.

11,056. You use soap and oil?—Yes.

11,057. What is the character and quality of the soap that is used?—There is hard and soft soap.

11,058. Can you give us any idea of the weights?—No.

11,059. What do you do with the refuse water?—The refuse from the wool-yarn washing we convey into tanks and extract the oily matter from it, and the result is, that comparatively pure water is passed down the brook.

11,060. Is that operation carried out by your firm?—Yes, it is.

11,061. Do you know what weight of grease you extract per week, or month, or year?—Something like two tons a week.

11,062. Is it worth about 18*l.* a ton?—Yes; that is about the price.

11,063. Do you sell the grease?—Yes.

11,064. What becomes of the sediment remaining after the extraction of the grease?—It is carried away.

11,065. And sold to the farmers?—I cannot say.

11,066. What weight is it?—I think the farmers do not quite like it, and that it is accumulating; we are obliged to destroy it in some way. I know that it is not taken away so readily as we could wish.

11,067. You do not carry it into the river?—No.

11,068. (*Professor Way.*) Perhaps it does not go direct to the farmers; it may pass through the hands of the manure makers?—We have tried it; my brother had some of it sent to his estate, and he has tested it; he does not find that there is any great commercial value in it.

11,069. The water that comes from the pieces goes away into the river?—Yes.

11,070. You cannot give the weight of that refuse?—No.

11,071. (*Chairman.*) Do you make your own gas?—Yes; a large portion of it, but not entirely; we take part from the corporation.

11,072. What becomes of the refuse that you make in your gas manufacture?—It is sold; the ammoniacal part is partly used by ourselves and partly sold.

11,073. Do you pollute the stream with anything from the gas manufacture?—No.

11,074. Do you suffer any injury from any gasworks above you?—I cannot say that we do.

11,075. Did you hear the evidence of the town clerk as to the form which future legislation might take with regard to river basins?—I heard most of what he said.

11,076. Have you at all studied the question of how the pollution of the river is to be prevented in future?—I have seen for many years that the evil is augmenting, as manufactories have been established upon the banks of our river. I can see the importance of attention being drawn to this matter, and I hope some plan will be devised for mitigating the evil; but I must say that after all the thought I have been able to give to the subject, it has appeared to me to be surrounded with great difficulties. I have been a member of the corporation for many years, and I know that the arrangements for the sewage of the town were laid down upon the basis of ultimately taking away the soil, or the injurious portions of the sewage, so as not really to pollute the river. The outfall was placed by Mr. Ranger very much upon the basis that something would be done to utilize portions of the town sewage; but the difficulty of disposing of dyewater discharged from our dyeworks, is a difficulty of which I must say I do not see any solution.

11,077. Did you see in this morning's paper an abstract of Mr. Ripley's evidence of yesterday, as given at Bradford?—I did not.

11,078. Do you accept the estimate of the annual value of the woollen manufactures of Yorkshire made by Mr. Ripley, as president of the Bradford Local Chamber of Commerce?—I should not be able to answer him, I am afraid, as to the figures, although I have had occasion to get up some statistics of that kind for this very district.

11,079. Have you any recollection what those statistics were?—I am afraid I have not.

11,080. Would you be surprised to learn that Mr. Ripley estimates the value of the worsted trade at something like 25,000,000*l.* annually?—Is that the entire worsted trade of Yorkshire?

11,081. The entire worsted trade of Yorkshire; the entire worsted and woollen trade of the United Kingdom is upwards of 64,000,000*l.* annually. If that enormous annual value is involved in the trade of the country, I assume that you would say that any regulations to interfere with it should be very carefully considered?—I should indeed.

11,082. That they should be considered with the utmost care and judgment?—It is of the utmost importance. Where such a large mass of artizans and working people are dependent for their means of subsistence upon trade of that magnitude, it must be self-evident that to interfere with it needlessly would be a very great crime. But something ought to be done to protect our rivers from the evils which, I am afraid, if continued in their present form, will be most injurious to health and to life. I am quite sure that the state of the lower part of this town at the outfall is a matter which requires very great attention.

11,083. The question is bound up with various considerations. First of all there is the health of the district, and then there is the trade; and those two considerations are mixed up with the present modes of carrying on the trade which result at present in a certain amount of injurious pollution?—Yes.

11,084. And the question will be how that pollution can be diminished so as to benefit the inhabitants in their health and not to ruinously affect the manufacturers in their operations?—That, I think, is the desideratum, and to get a solution for that matter is of vital importance.

11,085. Persons generally judge more from themselves than from what is without. You having regulated your own enormous works so as not to pollute the stream which passes by you, may not have turned

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your attention so exclusively to this question as we have been obliged to do. Would you be surprised to hear from this Commission that at present in Yorkshire over many scores of miles of your rivers all the ashes created at manufactories are poured in. If a new mill is to be built, and the river happens to be the nearest point, the material excavated from the foundations is wheeled in. In the case of highways bounding the district the handiest means of getting rid of the road scrapings is taken—they are carted and tipped into the river. Scores of dyers and manufacturers pour in every part of their refuse without attempting to purify it or to utilize it. From the intercepted soapsuds, taking Yorkshire generally, at the present time 100,000*l.* per annum is returned back to the manufacturers by contractors for being allowed to deal with that soap refuse which formerly polluted the streams, and the estimate is that at the present moment another 100,000*l.* value of grease in the form of soapsuds is allowed to go into the rivers and to pollute the streams?—Yes.

11,086 Do you think that it would be any hardship if a measure were adoped to compel (I use the word "compel" advisedly) the utilization of that soap refuse, both that which is already voluntarily utilized and is paying 100,000*l.* a year, and that which, if utilized, might pay another 100,000*l.* a year? You would say that you at great cost have to carry on your manufacture by carting away your ashes: do you think that any individual who is now passing ashes into the river should be allowed to do so on the plea that it would cost him money to cart them away or otherwise dispose of them, and that he had alway, been accustomed to do as he does now?—I should say that so far as regards the articles you have mentioned, soapsuds, ashes, road scrapings, and all those things, there ought to be power in the hands of the authorities of any given district, at once and without any delay, to put an end to that state of things. I very well remember the time on the stream where our works are situated when it was the universal practice to throw ashes into it. We did it ourselves, as our neighbours did it; and it was such an evil that the manufacturers associated themselves together for the purpose of common protection, and to prevent it. We had several lawsuits upon that point. A decision was given in one instance to our prejudice, and it was the means, I believe, of somewhat dispiriting and breaking up our association. It was in the case of a person on the Calder (for our association applied both to the Calder and to the Hebble) and judgment was given against us on the ground that the person pouring his ashes into the river had practised the thing for a period exceeding 20 years, and the judge ruled that as he had acquired this right he might continue so to exercise it; on that ground our association got a little discouraged. But in the valley in which our own works are situated all the manufacturers agreed, by giving their signatures, that they would cease to put in ashes, and I do not think that that is now carried on to any great extent, at all events.

11,087. That would be binding simply as regarded the number of firms signing that bond?—Just so.

11,088. It would not affect persons beyond the range of that bond either above or below you?—No.

11,089. Neither would it affect the other parts of Yorkshire?—No.

11,090. Therefore, although half a dozen or a dozen or any number of manufacturers might combine, it would still leave the great bulk of the offenders at liberty to pursue their own courses?—It would, and I think that it is a very great evil. I see constantly in other parts of the district that the thing is done daily and in open day, and I think that the sooner that is put an end to the better.

11,091. If the whole of the pollutions cannot be kept out of the river, do you think that we may anticipate, that through the assistance of this commission, Parliament may be enabled to legislate so as to prevent a vast amount of the existing evil?—I am perfectly certain of it.

11,992. And not to injure the trade of the district?—Not at all. I am quite sure that ashes, and a great variety of the injurious matter which is now allowed to find its way into the river, might with the greatest possible advantage be kept out of it, and as it has been done with soapsuds, so it is just possible that chemists may devise some means of utilizing some other injurious articles, and turning them to some practical account. But I am quite clear that so far as regards ashes, and a great variety of other things, we should be only too glad to be compelled to keep them out of the river.

11,093. Then as to sewage; you, representing a firm employing as large a number of hands as most of the great works in the Yorkshire valleys, have found means of utilizing the soil refuse from your population, and turning it, if not to a very beneficial use, yet to use, without polluting the river?—Yes.

11,094. If it can be shown that there are thousands and tens of thousands of individuals in works situated at no greater disadvantage than your works, the sewage of whom is carelessly passed into the running waters of the district to pollute the streams, as far as it goes down, do you think that we might say that others should do what you have done?—It is quite easy, and it is not only easy, but it is desirable and important that it should be done.

11,095. And it would not be an obstruction to your trade if you were put under restrictions to that extent?—It would not.

11,096. First, you might keep out the sewage, and it would not be an obstruction to your trade?—Just so.

11,097. And then you could keep out the ashes?—They might be turned to profitable account. We make money by them, but of course not a great deal.

11,098. The water containing chemical matter may raise a more difficult question?—That is a more difficult subject.

11,099. You pollute the water by the colouring matter, that is to say, by mordants of various kinds, by acids and by other matters which enter into chemical combination with the water?—Yes. That is a matter which is, I think, surrounded by a great deal of difficulty. I think that there is a great deal of dyewood which might be abstracted and not be allowed to go into the river in the way that it does now. In our case, we do not allow it to go into the river, so far as we are able to prevent it; we cart it away.

11,100 At present there are hundreds of thousands of pounds of dyewood, both chip and rasped wood, sent down the stream?—Yes; which ought not to go, and need not go.

11,101. Is your dyewood used in the chip form or in the rasped form?—Both.

11,102. And you can retain both kinds?—We can very largely. I think that the chip could be altogether kept out, and that the ground-wood could to a very large extent be kept out.

11,103. Can you in any way utilize the chips, or get rid of them by mixing them with the fuel?—We burn them.

11,104. You put them under the boilers?—Yes.

11,105. Is the rasped wood capable of being utilized in that way to any extent?—I do not think that it is, because it comes from the works in such a wet form.

11,106. And you cart it away?—Yes, we take it along with the ashes, and make spoil of it.

11,107. Have you had any demand in this valley for ashes by the Railway Companies?—We had during the construction of the railway, and we occasionally have now, but it is very rare; at one time it was a great outlet to us and a great convenience.

11,108. (*Mr. Harrison.*) Will you be kind enough to tell us the depth at which you pump the water in your well ?—I do not think that any of our wells are very deep, but it is a department with which I have not much to do ; perhaps 25 or 30 yards is the depth, but we have mined a good deal under our own property, and in that way we have got a very large amount of water.

11,109. Can you give us the cost at which you are for pumping the water ?—I am afraid that I could not speak with very great accuracy, but I think that it is under a penny per thousand gallons, or about a penny.

11,110. You have given us the weight of wool which you use in your works, can you give us the weight of cotton ?—We use I should think from 25 to 30 tons of wool a week, and I should think that we use cotton to the same extent ; perhaps not quite so much.

11,111. Can you give us the weight of oil which you use ?—I shall be happy to furnish you with all that information accurately.

11,112. Can you furnish us with the weight of solid dye woods ?—I shall be very happy to furnish that information.

11,113. Did you hear the remark of the Town Clerk as to the necessity for preventing the towns from taking their water supply from the Calder proper ?—I did.

11,114. Do you agree with him in his proposition that the town of Wakefield should be compensated by the whole of the area of the Calder for their water-works, so that they might be enabled to go to some other source for their supply ?—I am not prepared to say that I should exactly endorse that opinion. I think that a supply from the river in its present state is altogether out of the question for domestic use.

11,115. If the tributaries are not polluted in future as they are now, the Calder at Wakefield might be restored to a comparative state of purity, and not be an objectionable source of supply ?—So long as we have so many dyeworks on the line, and so long as that large body of water is turned from the manufactories into the river, I should very much doubt whether any town so near as Wakefield could with any kind of satisfaction use the water for domestic purposes.

11,116. Might not that question affect the towns below Wakefield more than the area of the Calder above Wakefield. It might affect Castleford, and Pontefract, and perhaps Goole. It might be an advantage to the town of Wakefield to be paid so much to go to another source of supply ?—If any one town comes in for compensation there were other towns along the line which I have no doubt would be very eager claimants.

11,117. (*Professor Way.*) If you now find a great difficulty in water supply, and if that difficulty increases for domestic purposes, the tendency of any measure for preventing impurities would be at the same time to make it easier for towns to be supplied with domestic water ?—No doubt of it.

11,118. Because the water which is now used for manufacturing purposes would be liberated ?—Quite so.

11,119. Therefore the point to aim at might possibly be to prevent impurity, instead of allowing impurity to be made, and then going to a fresh supply ?—Quite so.

11,120. At all events, I suppose that in your experience, water which is not so impure as the present streams and rivers in this neighbourhood which may not be fit for domestic supply, may still be fit for manufacturing purposes ?—Yes ; for condensing purposes, and if not very much polluted with dye-water, for dyeing purposes. The difficulty which has presented itself to my mind in keeping separate the dye-water, and passing it on without its being used for a considerable distance, is that those who have water power on the line, and to whom it is an object to have their wheels propelled, would say that this water was just as good for them as power as if it was ever so pure.

11,121. But you agree with the town clerk in saying that the water power as compared with the steam power of the district is very inconsiderable ?—It is very inconsiderable indeed. It is getting less and less, I think.

11,122. (*Mr. Harrison.*) In your own case I think that your water power is about 10 horse power ?—Yes.

11,123. Whereas the steam power which you have erected is 360 horse power ?—Yes.

11,124. For that 360 horse steam power which you have, what volume of water do you suppose you evaporate in the course of a day ?—About 120,000 gallons.

11,125. What would be the volume of water which you would use for your 10-horse water power ?—I am afraid to say.

11,126. It depends upon your fall ?—Entirely so. I really could not give you that information.

11,127. (*Professor Way.*) The chairman has very properly called your attention to the value of the woollen and worsted trade of the United Kingdom, which was represented to us as being something like 64,000,000*l.* per annum. A very minute percentage of that money would constitute a very large sum, would it not ?—I should think so.

11,128. The condition of this water, I suppose, is a very important item in the acquisition of this 70,000,000*l.* of money per annum ?—Certainly.

11,129. Could not that trade afford a reasonable amount of money annually for the purification of the water which they use ?—The great difficulty is in showing them how to purify the water.

11,130. Assuming it to be possible would not the interest of the trade itself bear a certain tax ?—I think that it would. It is such an evil that if it can be shown that by any remedy we can get rid of it at a small expenditure the proposition ought to be entertained.

11,131. Whilst the general public would benefit by the purification of this water would the trade itself benefit also by it ?—I have no doubt that individuals having mills and manufactories upon the line would be benefited by it.

11,132. (*Mr. Harrison.*) For instance, taking your own case. I think you said that you received from the Water Company, when they could let you have it, 80,000 gallons a day ?—Yes.

11,133. What did you pay for that ?—At the time when we used such a large quantity the corporation had an enormous supply, and they put down the price at a very low sum I think, 3*d.* per thousand gallons.

11,134. Would not that be about 1*l.* a day or 300*l.* a year even at that low price ?—It would.

11,135. If the brook had not been polluted as you say the Hebble brook is polluted, could you have obtained that volume of water from that brook for your purposes at a much less cost than that ?—We could have had it without any cost at all, for it would have been ready for pumping from the surface of the river.

11,136. In that case you have data by which you can reckon to some extent the cost to which you are put by the pollution of the river above you ?—Yes, I should think that we have spent 5,000*l.* or 6,000*l.* upon those wells alone. We have spent very large sums in acquiring properties higher up with a view to protect what is called the Ovenden brook. We have made an arrangement with one party who had a dyehouse on the stream and it has ceased to work, and we pay an annual sum in consideration of its not being started again.

11,137. Can you put those different items together and let us have them, so as to show what is really the cost to which you have gone in obtaining the pure water which you require for your manufacturing purposes ?—I shall be very glad to furnish you with all that information. We have been so hampered for the want of pure water that we have had to buy the thing up. We have bought lands and I think two mills higher up, and the right which was acquired by other parties upon the land.

11,138. If you put all those items together, they

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appear to come to a considerable sum?—They would do so.

11,139. And it would represent a considerable annual charge?—It would.

11,140. A charge much larger in all probability than any expenditure to which you would be put in purifying even your dyeworks?—I think that that is very likely.

11,141. (*Professor Way.*) You have spoken of the necessity of the pure water for your purposes. May we take it that for some part of your operations purity means cleanness, that is to say, that water without sediment in it and without colour would be sufficiently good?—Quite so. For some purposes we require water transparent and quite pure, that is for what we call steeping purposes; the object of steeping is to extract the brimstone out of the yarns, which are pure white, and any colour whatever, even of mere mud or sand, will be very injurious indeed—anything which would give the water any kind of colour.

11,142. But a water which was not chemically pure might be still pure enough for many of your purposes?—Quite so.

11,143. The water coming down the stream, from works above you, if divested of its absolute colour, might be fit for your purposes?—For many purposes we should use it extensively.

11,144. (*Chairman.*) Is there anything further which you wish to add?—I do not know that anything occurs to me. I have been very much pleased to learn that this Commission has been instituted, and I am looking forward with very great hope that some practical result may come out of it, for I am quite satisfied that the matter is one which really needed investigation, to say the least, in order that some measure, if possible, may be devised to remedy the evils to which the streams and the parties on the line are subject. I am very happy that the matter has been taken up in this way, and I hope that something may come of it.

The witness withdrew.

Colonel Edward Akroyd, M.P. (Halifax), examined.

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11,145. (*Chairman.*) You represent the borough of Halifax in Parliament?—I do.

11,146. How long have you been engaged in manufactures in this part of the country?—Our first works in this neighbourhood were at a place called Bowling Dyke immediately above North Bridge; they consisted of a mill turned by steam power, originally 30-horse power. That mill was purchased by my father in 1817.

11,147. And I assume that it has been very largely extended since that period?—The space at Bowling Dyke is limited, but in other localities our works have been extended,

11,148. Have you been engaged with your father in manufactures since your boyhood?—Yes, my father migrated to Halifax in 1817 from Brook House, on the upper branches of the same stream.

11,149. Do you remember the condition of the stream at that period?—I do.

11,150. What was it as compared with what it is now?—Of course the river was very much purer at that time than it is now. I may state, in order to put the matter rather more in detail, that in 1817 the works above us on the stream were those of Messrs. Crossley, to which Mr. Crossley has already referred, and then above those I think there were upon the Ovenden beck the dyeworks of Messrs. Crossley, and subsequently the dyeworks of Messrs. Rawson. Then on the Wheatly beck there were the dyeworks of Mr. Irving. Our mill is situated immediately below that of Messrs. Crossley, a short distance below the confluence of the Wheatly beck and the Ovenden beck, which after their conjunction form the stream of the Hebble.

11,151. What is the special manufacture carried on in your works?—The worsted manufacture. Originally that manufacture was confined to goods made of wool exclusively. Within my own recollection, what is called the mixed goods trade has been introduced, one portion of the material being cotton and the other portion wool, and I believe that the first manufacturer to introduce it was my uncle, who had his works upon the same stream a little higher up.

11,152. What number of hands are at present employed upon your premises?—We employ altogether about 4,000 as nearly as I can make out; that includes adults and children, and short timers, but at one place, at Bowling Dyke, we have in round numbers about from 800 to 900 workpeople employed.

11,153. Do you use water very largely for your operations?—We use it for condensing purposes and for scouring wool.

11,154. What steam power do you employ at present?—At the mill at Bowling Dyke the nominal horse power is simply two engines of 45 horse power each, making 90 horse power, the actual horse power will be 380; that difference is the difference between the nominal and the actual horse power.

11,155. What weight of coal do you consume?—At Bowling Dyke about 2,500 tons per annum.

11,156. What amount of cinders result from the combustion of the coals?—About 400 tons, as nearly as I can make it out.

11,157. What becomes of those ashes?—In former days the whole of those ashes were thrown into the brook; they were generally placed at one side of the brook and left there for the chance of a flood like that which we have unfortunately to-day to sweep them away. I was one of the parties who joined the association to which Mr. Crossley has referred, and since that period we have carted all our ashes away, so that at present none of our ashes are put into the brook.

11,158. Do you know what it costs per load to cart those ashes away?—I think that you cannot fix a definite sum, because it depends very much upon the distance to which we have to lead the ashes. To my firm it was not very costly because we had an old quarry, a sort of hollow space, which we filled up in that way.

11,159. Then it costs you the expense of conveyance between your works and the quarry?—Yes; but as that quarry is pretty nearly filled up, the expense is rather greater now; it is a fluctuating sum.

11,160. But the ashes are taken away at a cost to yourselves?—Yes.

11,161. What arrangements have you for getting rid of the soil matter from the hands employed upon your premises; have you waterclosets?—We have both waterclosets and privies. Our mill has been extended, and in the new portion we have a cart underneath the privies. The mill at Bowling Dyke is built perpendicularly, it is not on the shed plan; it is a spinning mill, and the privies are arranged one above the other, the soil falls down a sort of conduit, at the foot of which is placed a cart into which the excrements fall; sometimes we put a deodorizing powder into it. That is one set of privies. The other set is in the nature of waterclosets, the contents of which fall into the brook. I was induced to try the waterclosets from the fact that the smell from the privies was exceedingly offensive, and found its way up to the door so that the workers very near the door of the privy were very much annoyed by the smell; in short, we found the privies a more objectionable mode as regards the workers than the watercloset.

11,162. But the watercloset, so far as it goes, tends to the pollution of the brook below you?—No doubt it does.

11,163. Have you seen any of the earthclosets which have been recently introduced?—I have heard a good deal of them, and I had an opportunity yesterday, which I regret I could not avail myself of, of inspecting the earth closets of the West Riding prison at

Wakefield. I understood from the governor, Captain Armytage, that those earthclosets had been working exceedingly well.

11,164. I assume that you are a magistrate of the county?—I am one of the visiting justices, and I attended the meeting yesterday in that capacity. In comparing the one mode with the other, allow me to say that in our waterclosets we have underneath an outfall pipe a sort of grating formed to catch all the more solid matter, the liquid matter finding its way through. I requested my engineer to make an experiment there of putting a small filter bed, having a layer of sand for a certain distance, so that the water falling through the pipe should pass into the filter, and by that means we shall be able to reserve all the solid matter.

11,165. I think that you have been a member of Parliament for several years?—I was member for Huddersfield from 1857 to 1859, and I was returned for Halifax in the present Parliament.

11,166. You have taken part in the Imperial Parliament in legislating upon the sewage question upon previous occasions?—Yes.

11,167. I think that you have served as member upon some of the Select Committees appointed to inquire into this very question of the utilization of sewage?—I served in 1858 on "The Select Committee appointed to take into consideration Mr. Gurney's Report on the state of the River Thames, and such other suggestions as they may deem it expedient to entertain for its purification, especially in the immediate vicinity of the Houses of Parliament."

11,168. You had evidence before you upon that Committee from certain persons who were supposed to have special knowledge upon those questions?—Yes.

11,169. One amongst the number was Mr. Lawes, the great agriculturist?—Yes; and I may say that Mr. Lawes's evidence was taken at my suggestion, made to the chairman, Mr. Kendall. I had heard a good deal of the mode adopted for purifying the stream which runs by Leicester, and I wanted to have evidence brought before the Committee as to the mode of purification so adopted, with the view of ascertaining whether that mode was applicable to the river Thames, and in fact generally throughout the country. I may say that as a member of the Committee I was quite satisfied that the mode adopted at Leicester was capable of application to the river Thames and elsewhere; and the only objection to that mode which I heard advanced was that the precipitation of the filtered matter was not serviceable for agricultural purposes—that is to say that the refuse carried away was not commercially valuable; but as regards the primary object, the purification of the stream passing by Leicester, the evidence proved that the result was perfectly satisfactory. In fact, so successful was the experiment at Leicester, that trout, of which formerly there had been a great many in the stream running by Leicester, and which had vanished long ago, after the adoption of this mode of deodorization, came back to the stream and found it fit for their habitation. In the evidence given by Mr. Lawes, which seems applicable to the terms of the present Commission, reference was made to 30 different modes of deodorization, one being that adopted at Leicester, where the purification of the water was carried out very much by precipitation by the introduction of cream of lime. Another mode was that adopted at Cheltenham by filtration, and a question was put to Mr. Lawes with regard to the comparative value of the residuum from these two processes. Mr. Lawes said that at Leicester the residuum was comparatively valueless. The question was put to Mr. Lawes which of the two plans he considered the best. Mr. Lawes said that he considered the Cheltenham system superior to the Leicester system. Then the next question was this, "Have they tried it as a matter of commercial speculation." The answer was, "Yes; and their information was this, that it nearly paid its expenses." That is the filtration mode at Cheltenham. "They there filtered the sewage and mixed the residuum with the ashes, the dust, and dry substances of the town, and sold it to the farmers at 3*s.* and 4*s.* a ton, and I think that if they could sell it for 5*s.* it would pay the expenses."

11,170. With regard to that experiment, have you found that the effluent water from those filtering tanks carries away at least 9/10ths of the fertilizing matter and that the sludge taken out mixed with the ashes bears a very small relative value to the whole value of the ingredients which are drained from the town. Since that report was made the farmers have grown a little wiser by experience, and they will not give the price which they were paying at that time?—Just so.

11,171. (*Professor Way.*) The Royal Commission appointed for the purpose of making inquiry divided the subject into two questions;—first, will the process pay, and secondly, if it will not pay what will be the expense. We considered our primary inquiry to be how sewage should be dealt with?—And that I presume is the object of the present commission?

11,172. It is not necessary to make the process a profitable transaction in order to deal with sewage?—Exactly.

11,173. (*Chairman.*) I presume that you have a copy of our present commission, if not I will pass one over to you. You will see what the terms of the commission are. It states; "We have deemed it expedient for divers good causes and considerations that a Commission should forthwith issue for the purpose of inquiring how far the present use of rivers or running waters in England, for the purpose of carrying off the sewage of towns and populous places and the refuse arising from industrial processes and manufactures can be prevented without risk to the public health or serious injury to such processes and manufactures, and how far such sewage and refuse can be utilized or got rid of otherwise than by discharge into rivers or running waters" (it says nothing about profit or loss but that the water is to be got rid of if it cannot be utilized) "or rendered harmless before reaching them; and also for the purpose of inquiring into the effect on the drainage of lands" and so on. You therefore see that the commission puts before us the question of utilizing the sewage if possible, and if not, of getting rid of it; and that in all cases it is to be done so that it shall not be injurious to the processes and manufactures carried on, but it is no part of our business to establish a case that sewage can be got rid of profitably?—But still if it can be got rid of profitably of course all the better.

11,174. If profit arises out of it so much to the advantage of every person concerned?—Yes. Referring again to the inquiry by the Select Committee, I may say that I instituted an experiment with a view to ascertain whether at the outfalls of the existing sewers an apparatus could be arranged to deodorize the matter, and to pass the water into the river comparatively clear. I do not mean to say free from liquid manure, which perhaps is hardly visible to the eye, but, at all events free from all offensive qualities.

11,175. To clarify it from the sediment?—Exactly: that was my object. I was in communication with Mr. Gurney, and at my request he prepared me a small model of a barge from the model of a barge floating on the river. At one end of this small model I got the very worst specimen of the sewage liquid matter from the London sewers which was almost as black as ink. This was put into a large vessel and let into the barge at one end by a tap. I subdivided the barge into three divisions, the first had a comparatively open mesh, the second was a very fine mesh, and the third partition was divided from the end by a narrow filter bed three or four inches wide; in the last division I introduced cream of lime and I allowed the sewage to flow through this barge. It came in at one end in this black state and it went out at the other end perfectly clean. My object was to illustrate the possibility of filtration of sewage or precipitation in a very small space, and to let the liquid matter flow

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through until the floating barge should be charged with semi-solid matter, with the view that when one barge was so charged you might pass another barge under the outfall of the sewer in the same way, and float the barges up and down the river, and get rid of the nuisance in that way.

11,176. If you have perused the report published by the commission, of which Mr. Lawes and myself were members, you have found that that commission adopted that same idea upon a very gigantic scale. We showed how the river could be embanked and how the interior of the embankment could be made a filter bed to intercept the sewage, and to let the effluent water pass into the Thames, and that the sludge could be worked up by a screw pump and passed into carts or barges. But although we were a Royal Commission employed upon that very question our suggestions were never noticed?—My impression certainly as a member of that committee was that when we were arriving at a most interesting portion of our inquiry showing the possibility of deodorization of London sewage, at a comparatively small cost, our inquiry was cut short. I am aware that the ostensible ground was that the Session was drawing to a close, but my candid impression is that influences were brought to bear upon that committee with the view of shortening our proceedings, and of getting a report which by no means coincided with my views, for the purpose of sanctioning this immense outlay for intercepting sewers. The whole system of intercepting sewers struck me as being radically bad, for it proposed to draw out of the Thames, say at the upper part of London, a very large quantity of water at point A. and to pass it down to point B., at Greenwich or wherever it may be, and thus the intervening portion of the river between points A. and B. might be comparatively desiccated. If you draw out a large portion of the stream, it is evident that at low water between A and B the volume of water will be small, and there will be a difficulty in the navigation of the Thames. And you only shift your difficulty, for I believe that the deodorization piecemeal is better carried on than when applied to a flood of sewage which must be a nuisance at the particular point where the outfall occurs.

11,177. Our present inquiry is to deal with the rivers and streams in Yorkshire, they are of very much smaller volume than the Thames?—Yes.

11,178. They will therefore bear loss of water with much greater difficulty?—That is true.

11,179. Water is necessary both for power and for use; supposing then that any body of engineers should take it into their heads that interception upon the gigantic scale which has been carried out in London is necessary, and should propose to take up the foul waters from the several points and to convey them down to some point below, thereby depriving the intervening portions of the river of a large volume of water, what sort of effect would it have upon the manufacturing industry of this country?—It is clear that unless you can obtain water from other sources you prevent the possibility of mills being erected at those parts of the stream which are dried up in that way, and so far you injure the prosperity of the locality.

11,180. You cannot with any advantage repeat the mode of purification which has been adopted for the metropolis, I mean a great intercepting system?—Certainly not.

11,181. It has been stated that there are rivers where if you intercept the polluted water you dry the stream, and in fact destroy the river?—That is perfectly true, and I am not sure whether many of our corporations are not going upon an erroneous process of dealing with sewage. The system of depriving the river of the liquid sewage is radically bad, for this reason, that you draw out pure water from your original stream and do not return the water to it. I will assume that the stream is perfectly pure, Messrs. Crossley have the first draw, and although their neighbours sometimes suffer, I know that they take every means in their power to prevent their neighbours suffering from the nuisance, but, for argument sake, I will assume that all their dyewater is passed by a separate sewer so as to leave the brook pure. We come next, and the stream does not suffer from us, but it suffers from dyeworks down below, and there are so many drawers that by the time the river gets down to the lower part no water is left in summer time. Of course in winter the case is different. Then what is the result? It is true that you maintain your river bed comparatively pure, but still you have to deal with this sewage matter; I can speak rather feelingly upon that point, because I am the owner of Copley Mills on the left bank of the Calder, near the outfall of the Hebble, into the river Calder. I have let some of the land which I have there to a farmer who has used the Hebble water for irrigation upon his land there, and by means of the irrigation he has obtained very large crops, but I have a number of tenants at Copley village, and I found in summer time several cases of fever, which in my own mind I traced very much to malaria arising from this irrigation. I immediately reduced his rent very materially, and said "You must stop for the future this irrigation, it is a "nuisance, and it affects the sanitary condition of the "village."

11,182. (*Professor Way.*) How often do you fancy that that water is used over and over again?—For condensing purposes it is of course used by every mill on the stream; of course there is no objection to that, and it is tolerably often used for dyeworks.

11,183. Supposing that there are 20 mills on the stream, if every mill diverted the water which it receives, the water would not get down below the third or fourth mill?—No. Every time that the water is used for dyeworks, it gets worse. My own impression is, that this pollution of water should be dealt with exactly as we deal with the smoke nuisance, namely, that the party making the nuisance should get rid of it in some way or other. Of course, the objection naturally arises in old works. "How shall we find space for so doing?" especially upon the very excellent plan recommended by Mr. Ripley of Bradford, of subsidence; but I believe, that by filtration, and by the precipitation by lime, though objectionable in an agricultural point of view, you may restore the water even of towns, comparatively pure to the original stream. Only yesterday I got some of the water of the Hebble and made experiments with it. Passed through a common filter it did not come out perfectly clear, but when filtered with animal charcoal it became perfectly pure. From the rain which we have had, the water was not so dirty as usual, but I have been informed by others who have made these experiments, that you may make dyewater comparatively clear, so as not to be injurious to your neighbours, so as to be fit to be used for washing goods and for other purposes. If you can devise some process by which, in a short space, you can clarify this discoloured dyewater, you get rid of the whole difficulty and you throw the responsibility upon the parties who cause the nuisance. There are three ways in which you may do it; the first is subsidence, which requires a certain amount of space, and in some dyeworks there may be difficulty in getting space; the second mode is filtration; a moderately sized tank will be sufficient. The third mode would be the chemical one of precipitation to which many object, because you destroy the value of the products for agricultural purposes. But my impression is, that by a combination of those means you may purify the water, or restore it to a comparatively pure state. Then we come to the remaining question of the outfall of sewers. I believe that the mode of intercepting sewers is a false one; you may be apparently taking what is your own, but you injure all the property in the neighbourhood, and you injure the future development of that locality, and you are injuring posterity in order that the present generation may get rid of a local nuisance. Therefore, I believe, that the sound principle is, for the corporations to deal with the nuisance at the outfall of the sewer. As a practical man, I am satisfied

that it is quite possible to do so. We had it proved before the Sewage Committee on the Thames, that at Leicester the process of deodorization is not a nuisance to anybody, and that the water restored to the brook is comparatively clear. If it be possible, I say by all means put the saddle on the right horse, and let those who make the nuisance get rid of it. Let the outfalls of the sewers be where you carry on your deodorizing process, and I believe that by that means you may get rid of the whole difficulty.

11,184. (*Chairman.*) With regard to the irrigation which you complained of, was the land irrigated by sewage or by refuse water from manufactures?—It was irrigated by the river Hebble at its lowest portion near the canal basin, that is in its worst possible condition, for the Hebble becomes almost a sewer at that point.

11,185. You say that your farmer produced heavy crops by irrigation, but that you think that it was a source of nuisance, so as to cause fever?—There is no question that the crops were most luxuriant; he, I think, cut two or three times during the year. I found that during one season there were several cases of fever at Copley, more than usual. I have, myself, found the smell objectionable when I have been down there, and I was informed by the medical authorities, that the fever arose very much from the bad smells from the liquid sewage thrown over the land; and when I told the farmer that he must discontinue the process, he said that I must alter the rent, and I reduced the rent.

11,186. This question, as to the sanitary effect of irrigation, is one of a much wider bearing than this inquiry; it is most important; and if we have information of its being noxious which can be substantiated, it is our duty to act upon it; and if we have information which cannot be substantiated, it is our duty to declare it so. I wish to ask you a few questions with regard to this mode of irrigation. Have you yourself examined sewage irrigation works in other parts of the kingdom?—No.

11,187. You have not seen the Edinburgh meadows?—No.

11,188. There a very coarse system of irrigation has been carried on for two centuries, and charges have been made against that irrigation that it produces fevers; but searching investigations have been made, both with regard to some government barracks situated near, and with regard to the population resident around, and the result was that the irrigation was found not to have caused fever. Have you seen the Croydon meadows?—No.

11,189. The sewage of Croydon is poured upon certain meadows about a mile and a half from Croydon?—May I ask whether that is sewage matter?

11,190. The population of Croydon is about 30,000, and there the watercloset system is exclusively adopted. The whole of the effete matter from those 30,000 people passes into the sewers, and passes into the outlet, and the local authorities have an opportunity of putting it over something like 300 acres of land, but they put it over in sections of 20 or 30 acres at a time, about 1,000,000 gallons a day?—I can quite understand that that water is not injurious, it is very different from the Hebble.

11,191. Again at Worthing, with a population of 7,000, all the houses have watercloset, and the whole of that sewage is pumped, and has been for something like two years upon the land?—That I can understand. There is this distinction; the Hebble contains not only sewage matter but chemical matters, and it was proved in the Thames inquiry that in that case you create a sort of fermentation, and you raise certain gases which are most offensive to the smell and injurious to health. Sewage matter in a liquid state (as you have it at Croydon and elsewhere) I do not imagine would be very offensive, because most probably it might be taken up rapidly by the earth.

11,192. I have seen all the irrigation processes carried on, and I have yet to see the first example of malaria arising from such a cause?—I can understand that if you have one patch of land where you have sewage simply, and have it regulated, and if you have another patch of land where water containing chemicals is put, the result may be beneficial; but if the two are brought together into one stream I can understand what the result may be.

11,193. If the chemicals produce wholesome grass you may depend upon it that the objectionable matter is gone?—Before the committee on the Thames it was proved that the sewage matter floats on the top, and that the saline matter from the sea when it came into contact with that sewage matter caused fermentation. Some of the witnesses said that the fermentation which was so offensive in the Thames in 1858 was very much caused by the contact of floating sewage matter with saline matter from the sea.

11,194. (*Professor Way.*) Sewage matter proper has not a very enormous amount of sediment in it, but your manufacturing sewage, namely, the discharge of your sewers and brooks and streams in this district contains a mass of solid matter, and it is not improbable that plants may be smothered with the excess of deposit matter which in that case is thrown upon the land, but if the mode which you suggest of dealing with the impurity of the water were put in force, that is, if each manufacturer were compelled to keep out his refuse matter, the sewage would be ordinary sewage?—No doubt of it, but there would still remain certain chemicals in solution, and you cannot by filtration deal with chemicals in solution.

11,195. A remarkable thing about this district is that the amount of chemicals used has prevented the rivers from being anything like so bad as they might have been?—Yes.

11,196. (*Chairman.*) The Professor means to say the chemicals you use in your manufacture, so far from being injurious, act beneficially in preventing the effete matter of the population from being so poisonous as it would otherwise be there?—Yes.

11,197. (*Professor Way.*) The water supply at Wakefield is taken below the town just after the sewage is discharged; but when that water has subsided without any treatment whatever, it is a remarkably pure water as compared with the ordinary water of the town?—It was proved before our committee that sea water is specifically heavier than the sewage water. We had a beautiful experiment in which the sea water was, I think, coloured pink, and the sewage matter was black. By putting them into a glass vessel we found that the sea-water was invariably under a superstratum of sewage matter. It struck me that the water restored to the brooks from our dyeworks would also contain an amount of matter in solution which would be specifically heavier than sewage matter, and these two coming into contact might produce a certain amount of fermentation which might be injurious in a sanitary point of view.

11,198. There is no doubt that the mixture of sewage with salt water produces far more mischief than the mixture of it with fresh water, but that is believed to be due to the fact that the gases in the sewage are thrown out because they cannot be absorbed in water already saturated by salt. It is beyond doubt that Brighton and other seaport towns have suffered more than some inland towns. Your waters are not anything like so bad or so charged with chemicals as to go to that extent?—I should like the experiment to be repeated.

11,199. (*Mr. Harrison.*) How many acres of land have you in disposition near the junction of the Hebble and the Calder to which you could apply sewage?—Probably 20 or 30 acres.

11,200. Do you find any difficulty in passing the water from the Hebble on to that land?—No; the Hebble is considerably elevated above this meadow, which lies between the railway and the river.

11,201. Besides your property which you have mentioned, is there any extent of property similarly situated to which sewage might be applied?—Our works are on the left bank of the river, forming a sort of half-moon, bounded by the railway; on the

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other side of that railway there still remains a similar meadow which is not my property, and which is let by another party to the same farmer who holds mine, and where the irrigation process goes on in summer. I have observed that the process is very offensive in summer. The farmer gets very large crops from it. I am just reminded that there is a good deal of other land in that locality which is irrigated in the same way. The town clerk will be able to point that out better than myself.

11,202. Do you suppose that there are a few hundred acres to which sewage might be applied?—There are probably about 80 or 100 acres altogether.

11,203. Lower down the Calder is there any extent?—Yes, the land lies a little more favourably higher up the stream. Of course irrigation must be very much confined to the level bank or the sloping bank on the side of the Calder.

11,204. Under present circumstances is the land flooded?—Yes, the whole of the village of Copley is flooded, and the lower cellars are all filled with water at this very time.

11,205. (*Professor Way.*) Your principle is prevention rather than cure, is it not?—It is.

11,206. Just as a certain amount of cleansing, if continually carried on, will keep a building or a room clean?—Yes. I will assume for argument sake that all the chimneys in Halifax were taken into one smoke duct, and that that smoke duct was carried up to Beacon's Hill (an ingenious method which was started by a townsman of mine some years ago) it would be more difficult to deal with that vast volume of smoke than if you required that at each chimney the smoke should be purified.

11,207. (*Chairman.*) You would never know who was the rebellious subject if all were directed into one?—Just so. You must throw the burden in the one case on the whole town, and in the other case you could throw it upon the individual.

11,208. As far as practicable it will be advisable that each individual shall, upon his own premises, prevent the pollution of the stream which he uses and which flows past him rather than to attempt any combination of numerous manufactories, for the evil may not be so easily dealt with in mass as in detail?—Exactly so.

11,209. Do you use much soap at your mills?—Yes, a good deal.

11,210. You use both soap and oil?—Yes.

11,211. Do you know how many packs you use?—We may be able to give you the figures in the aggregate, but I am afraid that I cannot give you the amount used at Bowling beck.

11,212. Do you utilize the soap waste?—We do not do as Messrs. Crossley do, namely, extract the grease ourselves, but we dispose of the liquid produce to Mr. Gann and I believe that it is carried down to his works which are lower down the stream than ours, and he separates, I suppose, the fatty matter and restores the purified water to the river.

11,213. Would it be fair to ask what you are paid for it?—About 160*l.* a year; that is not merely for the Bowling Dyke soapsuds but for all.

11,214. (*Mr. Harrison.*) Does not all the refuse from your manufactories eventually run into the Hebble?—No, we have one set of works at Copley on the Calder, and in the borough of Halifax we have two sets of works. The weaving establishment lies on a much higher level than the establishment at Bowling Dyke, the lower one.

11,215. Can you give us the total weights of wool and cotton and flax which you use at all the works, and the weight of dyewoods and other insoluble matters?—We do not use any dyewood, we have no dyeworks of our own, we give all that work to be dyed by the dyers. With regard to wool I can only give it to you in round numbers. I can get you the information. I am not prepared to furnish it now. You want to know the total weight of wool and soap and oil used.

11,216. Is the soap refuse utilized from both your works?—From both the works at Halifax, and from Copley.

11,217. (*Chairman.*) I may state to you that the reason why we are asking you so minutely as to the soap used and the wool dealt with and the other ingredients is, that Professor Way may have all the necessary elements for consideration, and when he gets samples of the refuse as it comes now from your works, and of the effluent water from the works where soap-waste is treated, it will be his duty to see whether chemistry can teach how profitably any important saving can be made, or how the material can be dealt with in any other way than that in which it is now dealt with?—I shall be most happy to furnish you with every information in my power to assist the Commissioners in any way. The only water fouled by us is that arising from the soapsuds.

11,218. And which you now pass on to another party?—Yes, where it is purified by a process which of course Professor Way thoroughly understands. We have no dye wares of any sort.

11,219. If you compare the weight of the oil and soap expended upon your works, and the weight and value of the matter recovered from the soap refuse, you will find that they differ very materially; the inference is that a great proportion of the material passes away after all that you have done at present to intercept it?—I am obliged for the hint, and if you will allow me, before the Commissioners leave Halifax, I will give you a tabular statement furnishing all the information for which you now ask me.

11,220. Would you have any objection to filling up a printed paper if we should think it necessary to send one, asking for answers to these questions?—I shall be most happy to furnish the information, and it may be interesting in this point of view. I think that we are almost the largest consumers of long wool as compared with short fibre wool. The Commissioners must bear in mind that the trade of this district is a very mixed one; the trade of the Bradford district is chiefly in mixed goods, compounded of wool and cotton; but in Halifax you have the carpet trade, to which Mr. Crossley has referred, and you have furniture goods such as the curtains round this room and elsewhere, in which cotton is rarely used, therefore, those returns may be doubly valuable in that respect.

11,221. We have received the most valuable assistance from all the parties who have tendered their evidence, and we shall very probably find it necessary to frame a set of questions, and to send them out as circulars. You in the kindest possible manner have promised to fill in any circular which we may send, and I only mention it to say, that we shall be extremely grateful if other gentlemen connected with the trade who have given evidence, or who have been prevented from giving evidence, will do the same. We do not want to be inquisitive, but only to render the commission as practical as it can be?—I think that it is the duty of every manufacturer to furnish every information in his power, without any idea that it will be used prejudicially. I think that it is important to impose no conditions upon dyers, or others creating this nuisance, which cannot be easily fulfilled. Assuming for argument sake that it is possible to deodorise or purify dye water, it would be very hard to require a dyer who had too limited space to carry out such an operation. But it is my notion that this process can be carried on in a very small space, by tanks one above the other or in various other ways, and it is upon those grounds that I venture to throw out the suggestion.

11,222. You have mentioned the case of Mr. Ripley at Bradford; he is one of the largest dyers in Yorkshire; his works are carried on with an abundance of space about them on land which is his own property; he has certain tanks into which the refuse dye water is passed, and then the solids are abstracted from that water, and he is enabled to use or sell that water to several manufacturers below him. But there are scores of dyeing premises in Yorkshire which the

mass would be obliged at once to shut up if you said to them "Go to Mr. Ripley and do exactly as he does or you shall not carry on your trade?"—I have often observed the three reservoirs of Mr. Ripley where he carries out his plan of subsidence, and of course for that process you require a large area. The suggestion which I ventured to throw out was as to filtration and precipitation which may be carried out in a small space; but where the dyer has room for subsidence I believe that Mr. Ripley's plan may be the best.

11,223. But in that case you would have to present to the manufacturers or dyers an alternative scheme. You would say "There is one mode by which one "gentleman gets rid of his refuse; there is another "mode by which another gentleman gets rid of his "refuse;" and then the Professor might say, "I "believe that I have ascertained that you can dis- "charge this matter by another process which will "occupy so much space, and I recommend that to "your attention."—I have said that I would deal with this nuisance as with the smoke nuisance. For getting rid of the smoke there are 20 or 30 patents, but the Legislature very properly does not require the parties who create the smoke to adopt any particular mode of getting rid of it, but all that it does is to insist upon the purification of the smoke, and that it shall be completely harmless, and not opaque. Therefore if you apply the same principle to the water, you must declare that the water shall be comparatively clear.

11,224. Do you prevent smoke from your works?—We have endeavoured to do so; we have tried various ways.

11,225. Have you tried a patent?—We have tried Jukes's patent, and a variety of patents. There is a very great difficulty in dealing with patents, but I am quite sure that smoke may be dealt with. I noticed your remarks, Mr. Chairman, upon that subject at Bradford, and I think that Mr. Ripley stated that if you had an engine heavily burthened you must create more smoke than with one lightly burthened. I believe that he was quite correct in that remark. I believe that one mode of getting rid of smoke is to have sufficient boilers. I quite concur in the opinion of the chairman that a great deal may be done by firing. I saw eight or ten years ago Messrs. Ashton's system at Hyde, they had eight or ten boilers all in a row, and very little smoke came from them, the coals being thrown first on one side and then on the other; there was sufficient space there, and there was an abundance of oxygen to mix with the smoke and to get rid of it.

11,226. As a gentleman considerably concerned in manufacture and making some smoke in the district, and knowing the contamination of the atmosphere and that the goods in your premises are injured by the smoke, do you think that we have arrived at a period when it would be judicious to enforce smoke prevention regulations?—I should be most thankful if they were introduced, for I am a great sufferer from it. I have a very pleasant residence, but in the front of that residence, when the wind is in certain directions, I cannot breathe the air of heaven with any pleasure; sometimes the smoke comes in a dense volume from dyeworks near me. Therefore, I think that in all manufacturing towns it will be found that the public at large would be very glad to afford assistance in dealing with the smoke nuisance and the water nuisance.

11,227. With regard to smoke prevention (smoke burning as some term it) I am at issue with you upon one point. I think that when you are working your boilers there is a loss to you during the time that the fire is deadened, so as to produce smoke, and that you are putting an injurious strain on your boilers in alternately lowering the temperature and then getting up intense heat, for that process expands and tends to weaken the boilers. If, even with small boiler space, you compelled your firemen to fire at shorter intervals, and always to fire in the front of his boiler, you might work that boiler and get as much steam out of it, without making smoke, as you do now, and perhaps a little more steam power than when you make those dense volumes of smoke. Smoke is entirely the result of either ignorance or idleness, or both?—You will allow me to point out how far I agree with you, and how far I disagree with you. I perfectly agree with you that it is a false economy to overload the boiler and to have too thick a fire upon it. The amount of heat derived from a given quantity of coal, and the amount of steam raised, are much less with a great quantity of fuel on the fire than with a thinner stratum. But, nevertheless, if you have only one boiler, and must raise a given amount of steam in a certain time, it is perfectly clear that you must keep throwing on coals to raise the heat. It is true that if you throw the coals on all at once you lower the temperature till those coals are burnt up; but the fireman must be almost perpetually throwing on coals, and every shovelfull of coals thrown on causes smoke, and the amount of smoke caused thereby is much larger in proportion when the boiler is overburthened than when there is abundant space.

11,228. But space is not a ruinously costly thing—that is to say, if you have twenty nominal horse-power working, it does not occasion a very ruinous cost to put up a thirty-horse boiler?—The outlay will pay you a better interest than endeavouring to carry on the work by one boiler, I think that that is a false economy.

11,229. If the Legislature said, "You shall not work with a boiler which is forced beyond its capacity, but shall provide yourself with a boiler capable of doing its work?" there would be no great hardship?—I should say certainly not.

11,230. You say that it would be economy?—A man sometimes may be short of capital.

11,231. (*Mr. Harrison.*) You know the cells in the prison at Wakefield?—I do.

11,232. If they have earthclosets in cells where prisoners are confined during the whole day that is about as severe a trial as a system of that kind can be put to?—Undoubtedly.

11,233. So that if it is successful there you may take it for granted that it would be successful in your manufactory?—I presume it to be so; I have not fully informed myself upon the *modus operandi*.

11,234. What quantity of water do you use at your manufactories, and where do you receive it from?—We use about 400,000 gallons, I think, per diem at Bowling Dyke. I am confining my remarks to one mill, which is on the Hebble; that is the quantity which we use for condensing purposes. I believe that we get about one-half from the brook and one-half from the reservoir.

11,235. From what reservoir?—We have lately purchased land for the purpose of forming a reservoir; we have laid out about 3,000*l.* in reservoir space, which perhaps would have been unnecessary if the water had been perfectly pure. The reservoir to which I refer is our own reservoir.

11,236. Deriving your water from those two sources, I suppose that you have no occasion to pump?—We have a pump besides that; I can hardly state the exact quantity of gallons which we get daily from our own pump.

11,237. Do you receive any water from the corporation?—No; we have the advantage of being on the Hebble, the works on the higher ground, of course, receive a good deal of water from the corporation. At present, by reason of the brook and from our natural advantages we can dispense with the necessity of taking the town's water, which I may say is most excellent, and I believe superior to what we use ourselves. I am reminded that we use some portion of the town's water for washing wool, for which soft water is a very great advantage; that water is very superior to the water which is derived from the wells, which is hard. The town's water is not to be beaten in England; it is excellent water, and there can be none better.

11,238. That, of course, is a great advantage to the town?—It is an immense advantage.

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11,239. When the corporation can bring a greater quantity into the town, do you think that it will be used to a much greater extent?—A good deal of the town of Halifax lies above the level of the stream. When we first purchased the mill property in 1817 there were no mills above, but there are now mills on the upper plateau, all of which require water, and I believe that the supply of water will give the town a new start in its manufacturing career, and that more attention will be paid to its manufacturing prosperity.

11,240. It will also tend to the healthiness of the town by giving water to parts in a more elevated position, and where steam power is used manufactories may be scattered over the surface of the ground, and not compressed into a small space as must be the case when the brook is the only source of supply?—That is true; there are mills on the high ground where possibly in former days the idea of mills being erected was never dreamt of. We receive town's water at other mills than Bowling Dyke, and we also have sources of our own.

11,241. So that you have comparatively little pumping?—Yes; we have pumping in the lower part. We have driven a bore under the hill, and have taken a good deal of water from it.

11,242. Do you find that the supply from that source varies in volume?—Yes, occasionally, in a very dry season we have pumped the source dry.

11,243. That is not the source upon which you depend?—We are sometimes obliged to do so, failing the other sources.

11,244. At your works upon the Calder where do you get your supply?—Partly from a private well and partly from the river.

11,245. (*Chairman.*) Did you hear the remarks which were made by the previous witnesses, Mr. Crossley and the town clerk, as to the future management of the river basins of Yorkshire, under a board of conservancy?—I did, and I am quite in favour of such a board, assuming that you would have some central office in London, like the Board of Health, which would control these various boards, or which at least would be in communication with them, furnishing them with all the information required.

11,246. Do you think that from the conservators, whoever they might be, there should be an appeal to one of the Government offices, either the Board of Trade, or the Home Office, or to the Privy Council?—Exactly.

11,247. The manufacturers might settle amongst themselves, I suppose, which, in their opinion, it should be?—Certainly. I think that rivers administration should form a separate department. I think that the Home Office already has more than it can do.

11,248. Then there is the Board of Trade?—That would hardly answer.

11,249. Then there is the Privy Council?—You must have a distinct board; one more nearly allied to the Board of Health than any other.

11,250. The Board of Health is a department of the Home Office?—Yes, and this might be a department of the Home Office. All I mean is that it should not come under the general duties of the Home Office, but should form a distinct department.

11,251. But attached to one or other of these Government departments?—Yes; I think that you might with great advantage put smoke and water under one board.

11,252. Are you acquainted with the Act known as the "Alkalis Manufacturing Act?" Lord Derby, some two or three years ago, obtained an Act to prevent the pollution of the atmosphere by gases from alkali manufacture?—I know that there is such an Act, but I do not know much of it.

11,253. In the whole country around alkali works vegetation was being destroyed by gas sent out, and the owners of these works were put under restrictions not to pass away from their chimneys more than 5 per cent. of this refuse?—Yes, that is so, I believe.

11,254. They are under some inspection similar to the factory inspection, and since that period they have carried on the manufactures, complying with the Act of Parliament, and going very far beyond it, scarcely turning out any injurious gas from the chimney?—I have had some rather unpleasant experience of those chimneys at the works of Messrs. Crossley. There was formerly a hanging wood of beeches on a property belonging to my late father, and now belonging to my brother, and these trees being rather low, nearly all were destroyed. Messrs. Crossley, quite conscious of the injury they were doing, went to great expense in raising the chimneys, so that we now suffer no injury at all from that cause.

The witness withdrew.

Mr. J. Richardson.

Mr. John Richardson (Halifax) examined.

11,255. (*Chairman.*) You are engineer to the borough of Halifax?—Yes.

11,256. How long have you held that appointment?—Since April last.

11,257. Where were you engaged before?—I was city surveyor for Gloucester.

11,258. How many years were you so employed?—Two years,

11,259. Where were you engaged before?—For five years I was surveyor for the Barnsley Local Board of Health.

11,260. How long have you been engaged in sanitary works?—Since 1859.

11,261. Under whom were you articled?—Mr. Brooke, of Huddersfield. I was in practice for eight years before I held the appointment at Barnsley.

11,262. Upon what points are you prepared to give evidence?—I have a paper (*handing in the same.*)

11,263. What is the water-shed of the Hebble?—The water-shed of the Hebble amounts to 8,318 acres. There is a tributary of about four miles in length, and I have given you the area of the two.

11,264. What is the length of the valley?—I think upwards of nine miles.

11,265. What is the present condition of the Hebble?—The present condition of the Hebble is this: it is very much polluted with the sewage of the district and with the refuse from manufactories; and I should say, from an examination that I made of the river, that its bed must have risen considerably within the last 20 or 30 years.

11,266. Do any of the manufacturers beyond the borough throw ashes into the river?—I believe so; but beyond the borough there are very few mills.

11,267. Do you know of any mills the owners of which pass ashes into the stream, or any other kind of solid refuse?—I cannot point to the mills, but I know that, especially on Saturday afternoon after the mills have ceased to work, they do pass down a considerable quantity of refuse,—ashes, and other matters.

11,268. By flushing out their private dams?—Yes.

11,269. They take the opportunity between Saturday and Sunday night to get rid of that matter by throwing it into the stream?—Yes.

11,270. In your opinion does that tend to raise the bed of the stream?—It does.

11,271. Is that liable to be injurious to the property on the banks?—I think so.

11,272. What is the rainfall in the Hebble valley?—I have the result of nine years' observations of the rainfall at two places near Mixenden, a little below our storage reservoir.

11,273. Give me the largest rainfall and the smallest?—The maximum rainfall was 48½ inches in 1859, and the minimum was 31·4 in 1855, the average being 38·6.

11,274. Can you give it me in the same way in any other district?—At Warley Moor, upon which our works are being constructed, during 12 years the maximum rainfall was 59·8 in 1853, the minimum was 35·9 in 1864, the average being 47·8. On Ovenden Moor (the Ovenden is one of the tributaries of the

Hebble) during 12 years' observations the maximum rainfall was 57·2 in 1856, the minimum 35 in 1865, the average being 46·5. On the Midgley Moor, where there is another portion of our extended works, the maximum rainfall was 55·4 in 1863, the minimum 39·5 in 1864, the average being 48·35. In the town of Halifax observations made during 37 years give a maximum rainfall of 41½ inches during 1830, a minimum of 23·64 in 1864, the average rainfall for 37 years being 32·06.

11,275. (*Mr. Harrison.*) The maximum rainfalls appear to have occurred in different years?—Yes, that is so, and I was much struck one year with the difference of rainfall at two places which were about on the same level and within a very short distance of each other.

11,276. (*Chairman.*) What form of rain-gauges do you use?—The funnel-top form.

11,277. Without a spindle?—Yes.

11,278. Of ten or 12 inches in diameter?—10 inches in diameter.

11,279. How often are your gaugings registered?—Monthly.

11,280. How often are they examined?—We keep a man exclusively to look after these things. I have several other observations as to the flow of the Hebble and the flow of the sewage from the principal outfall.

11,281. Will you give us the flow of the water down the Hebble at any particular point, giving the maximum and minimum?—I will give you first the flow from the outfall sewer.

11,282. At what point is that?—The outfall is near to Water Lane nursery, that is the principal one; then there are six minor outlets.

(The further examination of this witness was postponed.)

The witness withdrew.

Mr. Frederick Smith (Halifax) examined.

11,283. (*Chairman.*) Are you a resident in Halifax?—Yes.

11,284. What business do you carry on?—I am a wire manufacturer.

11,285. Where are your works situated?—About 100 yards above the level of the beck on the banks of the river.

11,286. How many men do you employ?—Something above 100 men and boys.

11,287. What horse-power do you employ?—50.

11,288. In wire drawing?—Yes.

11,289. What weight of material do you deal with per annum?—About 1,500 tons per annum.

11,290. Do you use water?—Yes.

11,291. Where do you obtain it?—Entirely from the town supply, the reservoir.

11,292. What volume do you use in a week?—A little over 2,000,000 gallons per annum.

11,293. What do you pay per 1,000 gallons?—10*d.*

11,294. What weight of coal do you use?—2,500 tons per annum.

11,295. What amount of ashes do you produce?—About four or five cartloads per week.

11,296. What do you do with them?—We cart them all away, none go into the river.

11,297. Have you any waterclosets or privies on your premises?—Three.

11,298. Does any refuse from these flow into the river?—Yes, all of it.

11,299. Have any complaints been made by your neighbours below?—None whatever.

11,300. Do other manufacturers do the same?—Yes, I believe they do.

11,301. What material do you use in your business besides iron and water?—We use a large amount of sulphuric acid and muriatic acid, about 90 tons in a year.

11,302. For what purposes do you use those acids?—For cleaning the wire from the oxide; the iron gets a little rusty in the raw material, and we take the oxide off with sulphuric acid.

11,303. What do you do with the waste acids when they have served their purpose?—They become largely impregnated with oxide of iron and they are turned down a drain into the river.

11,304. Is that waste liable to be injurious?—Quite the reverse I think; I believe that oxide of iron a good deal mixed with lime water is rather a good disinfectant or deodorizer for an impure stream.

11,305. Do you do anything at all to prevent smoke from your premises?—Nothing, except by careful firing.

11,306. Do you make much smoke or otherwise?—We do not make much, we have not been complained of.

11,307. Is it not possible to fire so carefully as not to make much smoke?—Certainly.

11,308. When you see a dense volume of smoke emitted, should you say that it was from small boiler room or bad firing?—I should think it was both combined.

11,309. Might you not have much smoke made where there was plenty of boiler room?—Yes; but if so it would be in consequence of injudicious firing.

11,310. Do you not think that there might be a small volume of smoke even with small boiler room by firing carefully?—Where you have small boiler room it is a difficult matter to prevent smoke.

11,311. Are you at all annoyed by the pollution of the stream above you?—Not at all; we get all our water from the town. Perhaps this acid when it gets into the stream would be mixed in the proportion of about one gallon with 125 gallons of water.

11,312. How many grains of iron do you suppose there would be in a gallon?—I cannot exactly say, but not very many.

11,313. Do you know what is per-chloride of iron, that is used for disinfecting?—I do not know much about it.

11,314. (*Mr. Harrison.*) You would have a considerable amount of sulphate of iron?—Yes.

11,315. Do you know that there are works established within the valley of the Aire and Calder to procure sulphate of iron?—I do not.

11,316. At Wakefield I believe there are some. Are you aware that sulphate of iron is an article of commerce of some value?—Yes.

11,317. What is its worth per ton here?—I do not know.

11,318. Have you ever taken any steps to separate the sulphate of iron from the water that is used?—None whatever, we never thought it would be of any use.

11,319. Are you aware that it is done?—Not in our trade.

11,320. I believe the crystals are worth 3*l.* or 4*l.* a ton?—I am not aware of that; and I am afraid that we should have more trouble in doing it than it would be worth.

11,321. (*Chairman.*) Do you not think that you could concentrate the acid by using the same water until you saturated it?—No, we cannot use it after a certain point, it will not act upon the iron. We have large stone cisterns, they are not made of lead, these are filled with hot water and sulphuric acid, and they are worked as long as it is necessary to clean the oxide of iron. After two or three times we let off the liquid, we pull a plug out and let it go. Only a very small portion of sediment would come from a ton weight of wire.

11,322. Your iron I suppose is the best iron?—Yes, we use Swedish iron in great measure, and we use the best English charcoal.

11,323. (*Mr. Harrison.*) What is the cost of the acid that you use?—Between 400*l.* and 500*l.* a year.

11,324. What do you lose in weight of 1,500 tons of iron?—We make a great deal of waste, little bits, that

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we sell to the copperas manufacturers; we should make I think about 15 or 20 tons of waste in broken pieces in a year.

11,325. How much wire would you make from that quantity?—About 1,470 tons of wire, and of the oxide acting upon the surface of the wire, there would not I think be left above one or two pounds per ton.

11,326. (*Professor Way.*) I suppose the object of cleansing the wire is to coat it?—No; when it comes to us it is sometimes in a rusty condition, and we have to clean off the rust before we can draw it. After we have cleaned it with sulphuric acid we steep it in water, and after that we coat it with lime water.

11,327. I understand that you have a wire of a certain thickness, and you have to convert that into wire of a smaller thickness?—Yes.

11,328. And to clean off the coating of oxide you use sulphuric acid?—Yes, and muriatic acid.

11,329. By dissolving the exterior coat of iron, the oxide is thrown off?—Yes.

11,330. The oxide is dissolved in the acid?—Yes, in the acid and water.

11,331. Then you do not get a clear liquid?—No, certainly not, the oxide settles with the water in the cistern.

11,332. You get a coat of oxide of iron discharged from the iron by the action of the acid on the surface?—Yes.

11,333. It shells off?—Yes; it comes off quite clean.

11,334. When you use hydro-chloric acid it is partly one action and partly another; you dissolve part of the oxide of iron and part of the metal?—Yes; we use muriatic acid because its action is quicker; sulphuric acid does not take off the oxide so soon, and it requires the iron to steep in the acid for too long a time; for some purposes we use muriatic acid as being preferable to sulphuric acid.

11,335. Suppose the rust of iron is wanted in any large quantity, how is it to be obtained?—I think we could supply it with our waste wire, which is always exposed to the weather in far greater quantities than it is wanted. It is in small thin pieces of wire, which are as rusty as an old horseshoe.

11,336. If I wanted to make a large quantity of per-chloride of iron, where is the per-oxide of iron to be got to do it?—I do not know.

11,337. Do not you produce a very large quantity of per-oxide of iron in an insoluble state?—Yes, but it runs down the stream.

11,338. If a demand occurred for it could you stop it?—Yes, we could if we placed the outlet from the tank a little above the surface of the bottom; the water would run out and we could take out the oxide of iron.

11,339. What is the weight of iron that comes into your premises and the weight of manufactured goods that goes out?—1,500 tons.

11,340. The difference would arise from the oxidation?—Yes, and still more from the waste broken pieces, small bits, as long as my arm, or perhaps 30 inches in length, are continually broken off and accumulate, we have tons of them that we scarcely know how to get rid of, as rusty as possible.

11,341. Supposing all the oxide of iron which you now throw away, and which is an injury to the streams, was actually wanted to purify the streams, could you take any steps to collect it?—Yes, I think we could.

11,342. I need not ask you whether expense is incurred in oxidizing iron?—Of course there is.

11,343. Hydro-chloric acid is cheap, and you could make the per-oxide of iron cheap?—Yes.

11,344. The discharge which passes away is partly oxide of iron in mechanical suspension, and partly protoxide of iron or green vitriol?—Yes, and spent sulphuric acid.

11,345. What effect has that upon the stream?—Rather a beneficial one, I think. Much lime water is mixed with it also. We put the wires into cisterns and boil the liquid, and the stuff which comes out of the cistern is considered a good disinfectant. Oxide of iron and sulphuric acid, in their effect upon sewage manure I think are rather beneficial.

11,346. Are you aware that iron has been used to purify sewage at Cheltenham?—Yes.

11,347. And at Coventry?—Yes.

11,348. And that it really does precipitate the sewage in a prompt and successful manner?—Yes.

11,349. If the sewage be precipitated in the river, I presume the solid matter remains in the bed to be washed away by the stream?—Yes, of course it does.

11,350. If you had to deal with such a question you would rather take these things and mix them in proper proportions, than pass them into the river and trust to chance for the result?—Yes, of course.

11,351. (*Mr. Harrison.*) Do you find that the iron in the bed of the river consolidates the gravel and other matters thrown into the river to any extent?—I do not think it does.

11,352. Are your works similar to those which are carried on in Sheffield?—No. There are four other firms in the same trade, and therefore you can calculate the amount of this material which is used.

11,353. (*Chairman.*) What effect would restrictions have upon you, if you were prevented from passing your refuse water into the river?—It would be a very serious disadvantage if we could not let it off when we liked.

11,354. Would it interfere with your manufacture?—Entirely so. At the bottom of the cisterns we fix pieces of wood for the sediment to settle between, so that the wire does not touch the solid material; and after we let the water off we clear the sediment out. It is very nasty stuff; we have great difficulty in getting rid of it, for when we put it among the ashes, sometimes the railway people object to take it.

11,355. Supposing that no interference was used with regard to fluid refuse, would the circumstance of your being compelled to keep out solid refuse from the stream be of serious moment?—Not so serious a matter as a prohibition from passing fluid away.

11,356. You have to remove ashes, and if you could not turn your other solid refuse to any profitable use, your having to remove them would not destroy your trade?—No; but we would rather get rid of them as we do.

11,357. If all other persons were to be restrained from passing solids into rivers, should you wish to be exempted?—Certainly not. I should not object to any scheme that was made universal, so long as we were able to pass the liquids down.

11,358. (*Professor Way.*) Are you not discharging a large quantity of iron in the shape of oxide of iron and sulphate of iron into the river, for which, if a demand should spring up, you might obtain an income?—If that was to occur, we should be glad to adopt some means of intercepting the refuse, but I am afraid there would be no demand for it in the condition we make it.

11,359. If your neighbours were compelled to deal with their sewage and their manufacturing refuse and salts of iron was one of the means to be employed, is it not possible that you might be saving a great deal more than you would be losing?—Yes, certainly.

11,360. Do not you think that in many cases the value of a material is not found out by its possessors?—No doubt of it.

11,361. Take the case of tar and gas refuse, until it became compulsory to keep them out of rivers, there was no use for them, but the very necessity that compelled persons to keep them out of rivers directed attention to their use, and they are now found too valuable to be thrown away. May it not therefore happen in the case of your products that if you were prevented from throwing oxide of iron into the river, you might derive a great advantage from that circumstance?—Yes, we should be glad to find that that was the case.

The witness withdrew.

Mr. WILLIAM IRVING HOLDSWORTH (Halifax), examined.

11,362. (*Chairman.*) Do you carry on business in Halifax?—Yes, we are worsted manufacturers.

11,363. Where are the works situated?—Within a short distance of the town, at Shaw Hill.

11,364. Upon the banks of the Hebble?—Yes.

11,365. What number of men do you employ?—About 3,000 people.

11,366. Do you employ water power, or engine power, or both?—We use engine power exclusively.

11,367. What amount of horse power?—230.

11,368. What weight of coal do you use in a year?—About 25,000 tons.

11,369. What amount of ashes do they produce?—A very large quantity of ashes. I cannot exactly say the weight, but a considerable quantity of ashes is produced at our establishment.

11,370. Do you pass any ashes into the river?—We do not.

11,371. How are they removed?—All our ashes are carted away by our own carts to various places; the great bulk of them go to the railway and on to the roads in the district.

11,372. Do you use water for your manufacturing purposes?—We do.

11,373. To what extent?—We do not consume very much of the corporation water as we have private pumps of our own; for condensing purposes we take all our water from the canal.

11,374. You take a small quantity from the corporation?—Yes.

11,375. Do you know what the volume of that is?—According to a return that I have had from the office it appears to be somewhere about 10,000 or 11,000 gallons daily.

11,376. What price do you pay for it?—9*d.* per 1,000 gallons.

11,377. What volume do you lift from your wells?—I cannot say; perhaps 500,000 gallons a-day.

11,378. Do you dye upon your premises?—We do not.

11,379. Do you wash goods?—Yes, we wash the wool, using soap.

11,380. What weight of soap do you use in a year?—I cannot tell you the weight.

11,381. Do you do anything with your soap?—We use very large quantities of soap, and we dispose of our soapsuds to a manufacturer who manufactures on our premises.

11,382. How long have you disposed of your soapsuds?—For many years.

11,383. What weight of wool do you deal with in a year, or is it exclusively wool?—We use wool, cotton, and silk, but wool is the principal weight. The consumption of wool varies with us according to the state of the trade in the district, the largest consumption is generally at the rate of 300 packs per week.

11,384. What arrangement have you in the shape of waterclosets or privies for the work people?—In the mills and warehouses we have between 60 and 70 privies, and the refuse is all carted away into tanks.

11,385. It is not passed into the river?—Not at all; we have a few waterclosets, six or seven, connected with the works, the sewage from which finds its way into the Brook.

11,386. Do you use river water for any purpose?—Not now; we did in former years.

11,387. For condensing purposes you take water from the canal?—Yes, we do. I think we occasionally take a little water from the Brook with a small donkey-engine for the purpose of cleaning out the boilers, and we find the Brook water advantageous in that respect as dye water, and things that come down the Brook agree with our boilers much better than the canal water.

11,388. Have you any reservoir room or tank room on your premises?—No, nothing of that sort.

11,389. How long do you remember the river Hebble?—I remember it for the last 25 years.

11,390. What condition is it in now as compared with what it was when you first knew it?—Considerably worse, it is more impure.

11,391. Do you think that the bed of the Brook has been raised opposite to your premises since you first knew it?—I think there is not much difference in that respect, not near us.

11,392. What state is the river in to-day with this flood?—There is an enormous quantity of water coming down, in fact, the Brook is almost overflowing.

11,393. Are you liable occasionally to damage from it?—Yes.

11,394. If the bed of the Brook has been raised by accumulations, that would tend perhaps to damage you?—Yes.

11,395. If the bed of the river was lowered, you would be less liable to that?—Yes.

11,396. If there are parties above you who fill up the Brook by passing in solids, they are injuring your property, especially in a time like this?—Yes; we suffer not much inconvenience from the Brook, because we do not use it ourselves, but no doubt all these solids being thrown in tend to fill up the bed sooner or later.

11,397. In warm, dry weather, do you suffer any inconvenience from the smell or the stench of the Brook?—Yes, we do suffer very much; during the last two years, which have been dry seasons, we have suffered very much indeed.

11,398. You have been annoyed at your works and in your offices?—Yes, we have.

11,399. I suppose you would be glad if the Brook could be improved, and that state of things remedied?—Yes, certainly.

11,400. Do you think that the nuisance has been caused by the refuse dye water that has been passed in, or by sewage or both?—I should think from both. Of course I have watched the Brook very narrowly since the corporation turned the sewage into it, and there is no doubt that a greater nuisance exists now than before. Unfortunately for us the drain comes in just above us, and in a dry season we experience a great nuisance from it.

11,401. Does the outfall sewer empty itself above your works?—It does.

11,402. At what expense do you pump your water?—We have a separate pump for it, and the power is derived from the engine.

11,403. From the boiler which is doing the other work?—Yes.

11,404. What depth are your wells?—The principal one is about 25 yards.

11,405. Does the head of water vary at different seasons of the year?—It does.

11,406. When is it at the lowest?—I cannot exactly say. We have never suffered from a dry well, even during the two years drought, but the supply was not in the same quantity then as we have had it at other times.

11,407. Are your wells bore-holes?—They were formerly made for other engine power that we had in various parts of the works, but they were afterwards altered and converted into wells from which to pump water, to wash wool with and various other things.

11,408. Of what diameter are they?—Not very large, about six or seven feet.

11,409. Have you driven headings as Messrs. Crossley have—they have wells, and Mr. Crossley stated that they had driven headings or galleries into the stratification to intercept and bring in more water?—No; I believe that in one or two cases we have made a little headway of that sort.

11,410. Have you bore holes?—Yes.

11,411. To what depth do they extend from the surface?—I do not know.

11,412. Nor the diameter?—No.

11,413. So far as your experience goes, they have served your purpose in giving you water at all times?—I cannot say that they have served our purpose, but they have served a certain purpose which relates only to a very limited portion of our business; the great bulk of our supply comes from the canal and from the corporation.

HALIFAX.

Mr W. I. Holdsworth.

16 Nov. 1866.

11,414. What do you pay to the canal company for water?—We have three distinct sets of engines; two of them are within the prescribed distance allowed by Act of Parliament; the other is without that distance, and for that we pay 20*l.* annually.

11,415. Do you use the canal for traffic purposes?—Yes; we get a great quantity of coal by the canal.

11,416. You are a customer to the canal, and they accommodate you?—Yes.

11,417. You pay for that accommodation?—Certainly.

11,418. What is the quality of the water that you pump from your wells and bore holes?—It is hard water, much harder than the corporation water.

11,419. What makes it hard?—That I cannot say.

11,420. Has it any iron in it, so as to be objectionable to you?—Not at all.

11,421. It is not a chalybeate?—Not at all.

11,422. It does not affect your goods?—Not in the slightest degree.

11,423. Do you know the condition of the streams throughout Yorkshire generally?—I know that they are not so good as they ought to be. I know that most of them are very bad.

11,424. Do you think it is advisable to put any restraints upon manufacturers, who, at present, pass solid refuse into the rivers; such as ashes, and dye-woods?—I think it would be desirable to do so, as I do not see any very great difficulty in dealing with the solids; the treatment of liquids are a very difficult question.

11,425. Would you consider it a great hardship if you were compelled to keep out the refuse from your two or three waterclosets, if it could be shown that you could do so with some comfort and convenience to yourself?—We should be very glad to be shown any scheme that would improve the condition of the stream.

11,426. Although it would entail a few shillings of expense?—We should not object to that, if it was beneficial to the public.

11,427. Have you ever seen one of the newly-invented earth closets which have been introduced into Wakefield Gaol?—No.

11,428. If an earth closet can be placed in a cell 10 feet square, and the inmate can use it the year round without injury or nuisance, should you consider that a means of getting rid of the nuisance that may arise from waterclosets?—Not having seen it, I could not venture to offer an opinion about it, but any improvement of that sort we should only be too happy to adopt.

11,429. What amount of income do you derive from your refuse soapsuds?—I know it is under 200*l.* a year.

11,430. (*Mr. Harrison.*) Is it dependent upon the quantity of soap you use?—No; we have let it to a man who manufactures on the premises; he had a long lease some years ago, and he got it very reasonably; he pays so much per annum, and we engaged to send him all the suds.

11,431. (*Chairman.*) You do not trouble yourself as to what he makes?—No.

11,432. Nor whether you get an equivalent for what it is worth?—We think that this man has it too cheap now; he has had a long lease of it.

11,433. Do you manufacture your own gas?—Yes.

11,434. Do you pass out any refuse?—No; we pass nothing into the brook.

11,435. If any person who manufactures gas, pollutes the river with the refuse, I suppose you would say he ought, very fairly, to be prevented from doing so?—Certainly. I see no necessity for throwing anything from gas into the brook.

11,436. You can sell the ammoniacal liquor and the tar?—Yes; and we do so.

11,437. The coke you can consume under your own boilers?—Certainly.

11,438. (*Mr. Harrison.*) Have you ever made any calculation as to what it cost you to pump the same quantity of water that you might obtain from the corporation?—No.

11,439. If the water in the brook was pure, would you require to be supplied with that water which you now pay for to the corporation?—If it came down the brook pure and good enough for our purposes, we could save 20*l.* a year by taking it from the brook; it is within the distance of our engine, but we are not large consumers of the corporation water; we just simply take it for wool-washing because it is much softer than our own.

11,440. In an economical point of view, water is so valuable a commodity that it is important to you and other manufacturers that the pollution of rivers should cease?—Certainly, if it can be done without injury to the trade of a district.

11,441. If you were put to some expense to prevent it you might receive a *quid pro quo* by the purification of the river because you would be able to use the water;—Certainly.

11,442. (*Chairman.*) Do you use any apparatus for preventing smoke from your furnaces?—No; we adopted smoke-burners many years ago, but we had to discontinue them because we thought them very inefficient, they did not answer the purpose. Since then we have adopted a simpler method, which we think will be very good. We have erected one large chimney in the place of several others, and we have turned our smoke into this chimney. We place down about four or five additional boilers, we have always two or three over and above the regular work, and we make comparatively little smoke in consequence of that alteration.

11,443. What kind of fuel do you use, coal or slack?—We use two sorts of coal, one is small engine coal and the other is a larger kind, of a better class, and they are mixed together.

11,444. What is the cost per ton?—We pay now about 7*s.* 6*d.* a ton.

11,445. The coal is of a good quality which you expect easily to fire with without making much smoke?—Yes.

11,446. Have you tried the plan of throwing the onus of not making smoke upon the fireman?—Yes.

11,447. If you paid him a portion of his wages on the understanding that he did not make smoke, and if he did that you would deduct that portion, do you think that that might have the effect?—We have not put it in that way.

11,448. If you did so it would be no cost to you on account of the saving?—Unfortunately in these districts firemen are not so plentiful, and we cannot change them so easily.

11,449. A cheap man is the dearest person you can have about the premises?—No doubt of it.

11,450. Have you heard the opinions expressed by the previous witnesses as to the future conservancy of the river?—No.

11,451. Do you think that if the management were spread over the entire basin some beneficial measure might be carried out which should be useful to the whole of the manufacturers?—I have no doubt that the subject can be dealt with in such a way as to cause some improvement, more or less. What that may be time must show, but no doubt a very great improvement can be made.

11,452. You do not now put any ashes into the river?—No, but it was the common practice many years ago to do so.

11,453. Ashes went in with other manufacturing refuse when the mills were first established?—Yes.

11,454. You now cart them away as a matter of self-preservation?—Yes.

11,455. If there are other parts of the country where manufacturers throw ashes into the streams as you did formerly, do you think it would be ruinous to trade if they were prevented from doing it?—Certainly not, and I think that that is one of the things which ought to be dealt with at once.

11,456. If other parties abuse the rivers by throwing in solids, such as foundation materials or road scrapings, do you think that they ought to be prevented from doing it?—Certainly; there is no doubt that

there is a large amount of matter which goes into the brook that ought never to go there, and there ought to be some restriction placed upon that.

11,457. If you cannot utilize or clarify the dye water, you may, I presume, prevent the dye wares which are used from going in by intercepting them?—I should say so, either by burning or taking them away.

11,458. (*Mr. Harrison.*) Did you hear what Colonel Akroyd stated, which was that he pays so much, not merely to keep back the dyewoods, but that by precipitation with lime and filtration, the water from dyeworks may be sent out in almost a pure condition?—That is going beyond what I could say, because I really have not studied that part of the question; as for the solids I do not hesitate to say that they could be kept out without the slightest difficulty.

11,459. (*Professor Way.*) If the rasped wood was of value, and it was desirable to stop it from going away, there would be no difficulty I suppose in doing it?—Certainly not; and I apprehend that manufacturers would soon find that out.

11,460. In your view, how came the trade of this district to grow up; was it partly because coal was to be found in the district, and partly the existence of water?—Certainly, I should say so; both combined offered a great inducement to establish manufactories, water has been cheap, and also coal.

11,461. When the first manufacturers came to this district, they found the river sufficiently good for their purposes?—No doubt of it. Within my own time, we used to take all the water for condensation from the Hebble until it was so bad that we were obliged to go to the canal.

11,462. After a time, as the use of the water and the discharge of the water were equally necessary for them, the streams became more or less impure?—Yes.

11,463. I suppose therefore that the manufacturers have been using up their means of manufacturing in the act of polluting these streams?—Certainly.

11,464. They have been driven to other sources for water obtained either from wells or from distant sources?—Certainly; every manufacturer of importance in this district will have one or two wells of his own.

11,465. But I mean in the first instance?—Of course; but in those days manufactories were on a very limited scale and required very little water compared with what they do now.

11,466. If river pollution goes on to a greater extent, I suppose manufacturers will be entirely dependent for water upon foreign sources of supply?—Yes; in our own town a large number of manufactories are springing up in the upper portion of the town, on the hill side, where there is no chance of getting water from the river or brooks, and all the water that is wanted is taken from the corporation pipes.

11,467. And the price of that water is put on to the price of the goods?—Certainly it adds to the expense of the articles.

11,468. All the water is not used for purposes for which a pure water is wanted?—Certainly not.

11,469. If a manufacturer could get part of the water from the river in a moderately pure state, he might carry on his manufacture on the banks?—Yes, and it would be much better; he could carry on his establishment at a much cheaper rate.

11,470. And if every other manufacturer was placed in the same position, and was obliged to purify the water before it was discharged, he would do the same?—Yes.

11,471. (*Chairman.*) If you desired to double your present manufactures upon the present site, could you do so with your present means of obtaining water?—Yes, I think we could, so long as we had the canal adjoining, as we want the water there.

11,472. (*Professor Way.*) Where does the canal get its water from?—From the brook.

11,473. (*Chairman.*) Is not the canal water more or less impure?—It is very bad indeed, and I think that is the greatest nuisance we have to deal with.

11,474. If the brook were purified one great part of the difficulty would be removed?—Yes.

11,475. You could extend your works then with greater advantage to yourself?—Yes.

11,476. You have the greatest interest in the purification of the river above you?—We have.

11,477. If the river was purified above you, you would feel yourself under a moral obligation to send the water back again as pure as you could for the benefit of millowners below you?—Certainly.

11,478. Even if it cost you something out of pocket to do it?—Yes.

11,479. It would be a balance of gain and loss as between trade and the means of carrying trade on?—Yes.

11,480. (*Professor Way.*) Increase of trade, which means increase of population, will be checked at a certain time by the impossibility of getting water to carry on that trade?—Yes, that must be the effect sooner or later.

11,481. If there is an end ultimately of the supply of water, there will come a time when population and trade will not increase, because there will be no water either for domestic or trade purposes?—Yes; it is one of the great essentials for a corporate body to look to, to have plenty of water in a manufacturing town.

11,482. (*Mr. Harrison.*) Is the water in the canal getting more impure?—Certainly; during the last summer we found it was a very great nuisance in our own district.

11,483. If it continues to be polluted, shall you be able to resort to it as a source of supply for your works?—I doubt it, unless some steps are taken to purify it.

11,484. What should you do in such a case?—We should have to go back to the brook, or take the corporation water entirely.

11,485. If they could not supply it to you, what resource should you then have?—If they could not supply us, then we should be in a fix; we should be stopped altogether.

11,486. (*Chairman.*) You would be stopped within the limit of your pumping power?—Yes.

11,487. (*Mr. Harrison.*) If the canal water was as bad at Halifax as it is at Bradford, and people would not tolerate it any longer, and an injunction was obtained to stop up the canal, your supply would be cut off?—Certainly.

11,488. The question of water supply to you would be one almost of life and death?—Yes, it is a very momentous question indeed, and if any unfortunate thing of the kind you have just mentioned occurred, we should be thrown entirely upon the corporation reservoir for a great portion of our water; we should get some portion of it from our own wells.

11,489. Is not what I have suggested the clear tendency of things?—Certainly there is that tendency. It is a very unfortunate thing for the canal company that they take the water from the brook below the point where the town sewage is discharged, and they ought to make I think some alteration in that.

11,490. If you were obliged to take all your water from the corporation at 9*d.* per 1,000 gallons, do you think you could carry on your trade?—It would be a very serious expense I apprehend, according to the corporation scale of charges, the larger the consumption the less is the price.

11,491. (*Professor Way.*) If you spent 1,000*l.* in bringing water into your mills, would it be a very serious thing to spend 100*l.* in purifying it before you sent it out?—I do not know.

11,492. Water is the means by which you carry on your trade?—Yes.

11,493. It is an injury to everybody else when it is discharged in an impure state?—Yes.

The witness withdrew.

Adjourned till half-past 10 o'clock to-morrow.

HALIFAX.

Mr. J. Richardson.

17 Nov. 1866.

Halifax, Saturday, 17th November 1866.

PRESENT:

ROBERT RAWLINSON, Esq., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, Esq.

Mr. JOHN RICHARDSON further examined.

11,494. (*Chairman.*) Have you made any gaugings of the brooks connected with the town drainage?—No; but gaugings were taken in February 1865 by the then waterworks manager, for the purpose of ascertaining the volume of water passing down the stream. It does not appear that the result of those gaugings was worked out at the time, I have therefore taken them, and worked out the result.

11,495. Will you state briefly what results you have arrived at?—During the month of February the average flow of the Hebble brook during the working hours of each working day was 705 cubic feet per minute, or 507,000 cubic feet per day.

11,496. In what year was that?—In 1865. This flowincludes 1,000,000 gallons, passed out of the Ogden reservoir. The Ogden brook passed down 347 cubic feet per minute during 12 hours of each working day in the month of February 1865. These gaugings were taken immediately before the joining of the two streams at Lea Bridge. Then, during the same month, gaugings were taken below the principal sewer outfall upon the Hebble, after receiving the sewage of the town, and after the two streams I have named had joined, and the flow per minute during 12 working hours of each day was 1,502 cubic feet.

11,497. At what date was that?—February 1865.

11,498. (*Mr. Harrison.*) What was the volume passing during the other 12 hours?—That would vary considerably; in the first place, there would not be 1,000,000 gallons of water from the Ogden reservoir that would cease entirely; and the millowners would store as much water as possible in their dams for the next morning.

11,499. Any gaugings that could have been instituted would not have been reliable?—No—I may state that during these observations, the rainfall was about the average rainfall of the year.

11,500. What was that?—About three inches.

11,501. During how many days?—During the entire month of February.

11,502. Have you a table of gaugings from your sewer outfall?—Yes; I might just call attention to the different results obtained by comparing the flow at intervals of six hours in the same day. For instance, I will take the 10th November 1866 (there was no rain whatever on that day). During the first six hour, from 12 at night to 6 in the morning, the flow of the sewage amounfed to 154 cubic feet per minute; from 6 o'clock in the morning to 12 o'clock at noon it amounted to 274 cubic feet; from noon till 6 o'clock at night it was 221 cubic feet; and from 6 o'clock at night till 12 at night 261 cubic feet. I account for this larger quantity at night by rain having fallen at night; the observations as to the rainfall having been taken from 9 till 9, while these gaugings had been taken from 6 till 6.

11,503. I suppose you are aware that the flow of sewage in any system of sewers is in proportion to the water artificially supplied for domestic uses, and for trade purposes?—It is so.

11,504. It rises and falls according to the habits of the people, beginning in the morning, increasing a little at breakfast time, and then falling off at about 10 o'clock, then rising up a little between 12 and 1 o'clock, the largest flow being from 6 to 8 o'clock in the evening generally?—That is my experience here.

11,505. Sewage varies in flow according to the use of the water by the people?—Yes; in this case it would be also influenced by the use of water by mills, so far as they pass water into the sewer. The result is that the maximum daily flow of the water during the observations gives 659,822 cubic feet per day, and a minimum flow of 328,000, the average daily flow being 429,000 cubic feet per day.

11,506. That gives about 2,000,000 gallons per day?—Yes.

11,507. What quantity of water do you supply to the town?—About 1,300,000 or 1,400,000 gallons.

11,508. What is the size of the outfall sewer?—It is 5 feet by 3 feet 6½ inches.

11,509. Of what form is the invert?—Elliptical.

11,510. Is it egg-shaped?—No.

11,511. How much of the invert of the sewer does that volume of sewage occupy; is there a depth of three or four inches?—More than that, I think six or seven inches.

11,512. Out of how many inches?—Out of five feet.

11,513. Was the sewer full last night, during the storm?—Yes, it was. I had the gauge fixed in, and it has backed the water up.

11,514. Did the water in the river back it up as well?—I think not.

11,515. Was there any serious flooding last night?—Not particularly so.

11,516. No injurious flooding?—No.

11,517. The sewer has not burst?—It has a little, it has warped; but that was from the fact of the gauge being there.

11,518. There has not been any serious damage done?—No.

11,519. (*Chairman.*) Could you gauge last night?—No, the gauge dammed up the water until it lifted the top of the sewer.

11,520. What is the fall of the sewer?—One in 137.

11,521. The difference between 2,000,000 and 1,300,000 would be accounted for by pumping from the different manufactories?—Yes.

11,522. What is your next table?—The next table gives the sizes and lengths of the sewers.

11,523. Will you give me the lengths of the sewers; which is the smallest in sectional area?—The smallest in sectional area is nine inches in diameter.

11,524. What is the entire length of the main sewer; give the length, the diameter, and the rate of inclination if you can?—The largest sewer is 5 feet by 3 feet 6½ inches, and extends within the borough 1,143 yards; the gradient varies very much, it goes from 1 in 70 to 1 in 137.

11,525. Have you man-holes in that length of sewer?—Yes, we have some; I do not know how many.

11,526. Have you any ventilating shafts in it?—None. The next is a second-class sewer, and that is in length 2,090 yards; the diameter is 3 feet 6 inches by 2 feet 6 inches.

11,527. Are there any man-holes in that length?—Yes; I do not know the number of the man-holes.

11,528. Have they moveable covers?—Yes, they have.

11,529. Are they fixed at the street surface?—Yes.

11,530. Are there any ventilating arrangements there?—None. The next length is a third-class sewer, amounting to 2,413 yards; the size of the sewer is 2 feet 9 inches by 2 feet 3 inches, and the gradient is from 1 in 11 or 12 to 1 in 50 or 60. I do not know the number of man-holes there.

11,531. Is there any ventilation in that length?—None; we have no ventilators througout the town,

with the exception of connexions with the house fall pipes. The fourth class of sewer amounts to 3,580 yards, and the size is 2 feet 6 inches by 2 feet 9 inches.

11,532. Are the sewers made of brickwork?—No. They are generally made of stone; they are egg-shaped, nearly all of them.

11,533. Are they made in pierpoint stone?—Yes; 6-inch pierpoints. The next size is a square sewer. I think that is not part of Mr. Ranger's scheme; I think it has been introduced since. The length is 5,266 yards, and it is 2 feet square.

11,534. In what condition is the invert of that sewer, does it accumulate or does it keep clean?—It keeps clean; the gradients are so steep that all our sewers are very clean. The next is a square sewer. 250 yards in length, 3 feet by 2. Then we have 950 yards of a 4½-inch brick sewer, 2 feet in diameter; 166 yards of a 4½-inch brick sewer, 1 foot 6 inches in diameter, and 3,550 yards of pipe sewers, 15 inches in diameter.

11,535. Are they socket joints or half sockets?—Full sockets. The next size is 1 foot in diameter, and the length 6,500 yards.

11,536. Are these earthenware pipes?—Yes. I believe they are all full sockets. The next size is 9 inches in diameter, pipe sewer again, and the length is 7,980 yards. The total length of the sewerage within the town amounts to about 19 miles.

11,537. Have you experienced any difficulty in the management of your pipe sewers?—Not in this town.

11,538. Have they been flooded at all?—No.

11,539. Then as far as your experience goes, they answer the purpose for which they were intended, viz., to be street sewers?—Yes, they do.

11,540. They carry off the water passed into them, and they give you no trouble?—None whatever.

11,541. Have you had difficulties with pipe sewers in any other towns?—Yes. I had very great difficulty in the city of Gloucester.

11,542. How was that?—On account of the bad gradients.

11,543. Were they flat gradients?—Yes.

11,544. Was it also on account of bad laying?—I think so.

11,545. They were not regularly laid?—No; they were not.

11,546. Have you had choking and difficulties of that kind?—Yes.

11,547. If you had had no other experience than at Gloucester, you might have expressed an opinion against the use of earthenware pipes?—No; I think not, because at Barnsley earthenware pipes were used in a great measure, and I carried out part of that scheme myself. I found them answer there admirably.

11,548. Your experience is, that where earthenware pipes are sufficient for their work, and they are properly laid, they answer the purpose of public sewers?—I quite think so.

11,549. (*Mr. Harrison.*) How did you remedy the defect in the sewers at Gloucester?—By taking them up and relaying them.

11,550. Did you take up any considerable length?—About half a mile.

11,551. In what part of the town was that?—It was on the north-west side of the city.

11,552. (*Chairman.*) What have you further to state?—The next table is the length of the roads.

11,553. Have you tabulated the length of the roads within the borough under your charge?—I have.

11,554. Will you state as briefly as you can what that length is, and the character of the roads?—I have classified them as paved roads and macadamized roads, but I shall have to hand in that information afterwards.

11,555. You have certain papers which you wish to hand in?—Yes (*handing in the same*).

11,556. In the entire length of the sewers under your charge there is no systematic mode of ventilation?—None.

11,557. Have you discussed the question with your local board as to the necessity of ventilation?—I have.

11,558. Have they instructed you to make any plans for ventilation?—They have.

11,559. Have you carried out ventilating arrangements in any of the sewers you have previously constructed?—Yes, in the execution of the sewers at Gloucester.

11,560. Did you use charcoal for disinfecting the gases of the sewers before passing them into the atmosphere?—I did.

11,561. You will then have no difficulty in devising a proper method of ventilating the new sewers now under your charge, if the corporation instruct you to do so?—The corporation have instructed me to put down a system of ventilation.

11,562. Since the meeting yesterday, have you obtained some information as to the recent rainfalls and the state of your reservoirs?—Yes.

11,563. Did you go to your reservoirs last night?—Yes.

11,564. Which did you visit?—The Ogden reservoir.

11,565. Is that a large one?—Yes, it is a large reservoir used for storage and compensation water.

11,566. Of what area is that reservoir?—About 30 acres.

11,567. Do you know what the drainage area is?—1,140 acres.

11,568. What is the mode adopted in your byewash construction?—The byewash is a tower or cylinder, and the water falls vertically 66 feet.

11,569. What depth was it going over the lip of the byewash yesterday?—1 foot 10 inches.

11,570. What kind of effect did it cause in the wall?—The bottom of the bank was in a state of vibration.

11,571. Vibrating like an organ pipe with the rush of the water?—Yes.

11,572. Is there any difficulty in constructing a byewash on the solid, so as to pass the water down on to the solid ground in the river below?—None.

11,573. What is your opinion of that mode of construction?—I think it is much preferable.

11,574. If the masonry had given way what would have become of the bank?—The bank must have gone.

11,575. What amount of rainfall did you gauge yesterday?—About 4 inches up in that district.

11,576. Within what number of hours?—Within 48 hours.

11,577. What volume did it give you, flowing from the ground through that reservoir and out of it?—Upwards of 100,000,000 gallons during that time.

11,578. That was escaping from the reservoir?—Yes.

11,579. Was the water below the top of the bank or below the lip of the byewash when the rain commenced?—It was up to the top of the byewash.

11,580. Do you know what depth of water is going over the byewash this morning?—No.

11,581. Have you ever had so large a fall and so deep a flow over the byewash before?—Not in my experience.

11,582. You never saw the full effect of that volume on your bank before?—No, I did not.

11,583. What height is the bank?—66 feet to the water line.

11,584. If you calculate the velocity of a body of water falling through 66 feet, you will find that it reaches the bottom with almost the force of a cannon shot as compared, but if it falls step by step, it is landed at the bottom of the river, as easily as it was started at first?—No doubt it would be so.

11,585. What is the height of the bank above the lip of the overthrow?—It is about 3 feet 6.

11,586. If that is so, and the water was nearly two feet over your byewash, you had not above 1 foot

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6 inches of bank above your top-water line?—No, we had not.

11,587. Supposing this had occurred yesterday with a heavy gale of wind, you might have had all that water brought in one sheet over your bank?—But we have a very stout wall intervening.

11,588. What height is that wall?—Fully 4 feet 6 inches.

11,589. Then you must add the 4 feet to the 1 foot 6 inches of bank, and you would have 5 feet 6 inches intervening?—Yes; or 6 feet.

11,590. You are preparing a list of the mills, giving the names of the millowners, the form of power they use, the volume of water which is consumed, and other details, which, when completed, you will send in to the Commission?—Yes, I will.

11,591. (*Mr. Harrison.*) What is the diameter of that outer circle (*pointing to the plan*)?—8 miles.

11,592. That is the limit within which the corporation is authorized by Parliament to supply water to the different townships and villages?—Yes.

11,593. Is there any obligation on the corporation to find water for the villages within that circle?—I believe so.

11,594. It is not a permissive power merely?—No, it is part of our area of supply. By the provisions of the original Act, and the Waterworks Clauses Act, read together, we are bound to supply the water.

11,595. The system of waterclosets has not been carried out to any extent in Halifax, has it?—It has not.

11,596. Ashpits still exist I believe to a great extent?—Yes, we have some 1,500 or 1,600 ashpits, and probably 3,000 privies.

11,597. Are they situated in the parts of the town where the poorer population reside?—Yes.

11,598. What is the health of the people in this district as compared with others?—The ashpits and privies are generally very conveniently situated; that is to say, they are at some distance from the dwellings, and I do not think that the health of the poorer inhabitants suffers very much from the privies or ashpits.

The witness withdrew.

Mr. E. Ingham.

Mr. Edward Ingham (Halifax) examined.

11,599. (*Mr. Harrison*). Where are your works situated?—In Pelham Lane, within the town of Halifax.

11,600. What trade do you carry on?—I am a dyer.

11,601. What number of hands do you employ?—200.

11,602. What power do you use?—About 15-horse power.

11,603. What is that power?—Steam power.

11,604. What weight of coals do you use in a year?—5,000 tons per year.

11,605. What weight of ashes do you suppose they produce?—That I can scarcely speak to; we have a man upon the ground who takes a great part of the ashes away himself, the others we lead into the streets; we have no regular system of doing this.

11,606. You get rid of the ashes and none find their way into the stream?—No, we cannot do that.

11,607. Where do you get your water from?—From pumps and a spring that comes to the surface.

11,608. What depth are the pumps?—They are two miles above our place; perhaps they are 20 yards deep; there are wells there, and one spring in the same neighbourhood, which comes out at the surface, it comes by gravitation.

11,609. What volume of water do you use per day?—About 200,000 gallons.

11,610. What becomes of it after you have used it?—It comes down the town sewers.

11,611. What do you use it for?—For dyeing.

11,612. And some for washing?—For dyeing and washing, and for the engines.

11,613. What volume do you use for those three purposes; how much for boiler purposes?—We have five boilers, and they evaporate a great deal; we boil our vats with those boilers; we have about 15-horse power.

11,614. A 15-horse engine attached to the boiler would give 100-horse power?—Yes.

11,615. What volume of water do you use for washing wool?—I could not speak to that, we run it into a reservoir behind the works and use it; it is all used for washing and dyeing purposes.

11,616. What weight of wool do you pass through your works in a year?—I cannot speak to that; but it is a great quantity, 30,000 lbs. a week perhaps.

11,617. Do you dye wool?—Yes, and wool and cotton together, and a good deal of cotton warps, and some piece goods.

11,618. Those come to you to be dyed?—Yes.

11,619. Is the wool that you clean sent to you to be cleaned?—Yes; to be cleaned and dyed.

11,620. What is done with the refuse from your washing process?—It all goes down the drain now.

11,621. What do you use for cleansing the wool?—Soap in a great majority of cases; we use for bleaching purposes in cotton a good deal of soda ash.

11,622. What weight of soap do you use?—I have put down here 300 packs of soap per annum.

11,623. That would be worth reclaiming I suppose?—Some two years since I thought of that, and a practical man told me that he did not think it would be worth while from the way that we used the soap, that we had too great a quantity of water, compared with the quantity of soap.

11,624. Do you clean the wool with a machine?—Partially so; but it is nearly all hand labour, we just squeeze the soda out, but a great part of it is got out by an extractor, by centrifugal force.

11,625. Do you use a larger volume of water in cleaning your wool than is generally used?—I think three times the quantity, and more than that.

11,626. How is it that your wool requires so much?—Our wool does not require a strong soap lather, anything that would take a small quantity of oil out of it is all that we require.

11,627. What wool do you use?—The wool that we use has been already washed before it comes to us; it is in a half prepared state when we get it; it has had all the manufacturer's washing before we get it, and all our work is to take out a little oil that has been put on to make it work better, we get that out, and that is the only thing; a very thin soap lather is sufficient.

11,628. Do you think that the quantity of water used makes it hardly possible or worth while to take the soap out?—A practical man said that he did not think it would be any benefit.

11,629. Would not Messrs. Le Page and Company take it from you?—I do not think they would on that account, but I never asked the question.

11,630. Do you dye all the wool that you wash?—Yes, we dye or stove it—that is, make it white; it is scoured and submitted to fumes of brimstone.

11,631. Besides wool, have you some yarn and pieces to die?—Yes, we have a good deal of cotton warps and piece goods.

11,632. What weight do you dye per annum?—I should fancy we dye from 1½ tons to 2 tons of cotton warps daily, and piece goods, but I should rather include them in the 5 tons per day of wool.

11,633. Besides wool, do you dye cotton to any extent?—Yes.

11,634. Up to what weight?—From 1 to 2 tons a day.

11,635. Can you state what weight of insoluble woods and other dyes you use?—I can scarcely say, but we do not dye so much cotton as some of the

dyers who have given evidence before. I should say that there would be perhaps from 2 tons to 3 tons a week.

11,636. Of solid materials?—Yes, chipped and rasped wood.

11,637. (*Chairman.*) And other forms of solid refuse?—Yes.

11,638. (*Mr. Harrison.*) What are the soluble materials, acids?—I use 50 tons of oil of vitriol per annum, 12 tons of soda ash, 20 or 30 tons of alum, and perhaps 20 tons of other sorts—sulphates, sulphate of copper, sulphate of iron, and so forth. We also use from 10 to 15 tons of bi-chromate per year.

11,639. What is the soda used for?—For bleaching cotton.

11,640. Does that produce a disagreeable refuse?—No, I should think that the soda and the acids, when they came together, would neutralize each other, and would pass on quietly together.

11,641. What becomes of the insoluble materials, the dyewoods?—We burn them all; we have no means of getting quit of them otherwise than by letting them go, and we find it advantageous to burn them.

11,642. Is the wood that you use for dyeing chipped wood?—Generally so.

11,643. Is there any difficulty in burning the rasped wood?—Not particularly; we should do so if we had much of it.

11,644. In dyeing some goods, it is necessary to use rasped wood, is it not?—Yes.

11,645. Do you think that dyers who use rasped woods would find much difficulty in burning the refuse?—No, I should say not, because of the quantity they use. It depends chiefly on the quantity they use; a small quantity might pass away without observation, but I think that dyers could burn all their rasped wood with care.

11,646. You think there would be no difficulty in separating it from the liquid?—Yes.

11,647. And that it might be prevented from going away?—I am speaking as a cotton dyer. We scour the goods in the soap liquor, and it is then thrown down the drains.

11,648. What do you say becomes of the liquids after you have done with them?—They are all turned down the sewers.

11,649. Have you obtained permission from any person to pass that liquor into the sewers?—I suppose so. There were dyers in the place 20 years before I purchased it. I asked no questions certainly, and I have had no objection made to it.

11,650. Do you think that the town authorities could prevent your passing these liquids into the sewer?—I think not. I think there was an arrangement between my predecessor on the premises and the town, and, considering the time that the drain has been used since, I think a right has been established. It is 30 years since the drain was made.

11,651. That is not one of the sewers that has been constructed lately by the corporation?—No, but it empties itself into one. I think the party from whom I bought the premises made a drain himself down a certain road (that I am not very much acquainted with), but since that time there has been for a portion of the way a new drain made, and that empties itself into the town sewer.

11,652. Have you tried any experiment to purify the water after it has been used for dyeing?—No.

11,653. Do you know of any having been tried?—I think not. If there was any, I think the remedy would be worse than the disease. It would require so much ground and take so much time that it would be something like the Bradford canal, the greatest nuisance in the town.

11,654. Are you aware that Mr. Ripley does separate, not only the solids, but in a great measure the colouring matters?—Yes, I am aware of all his doings. He does out of doors just what I do indoors. I never put in anything that requires separation. He separates the solids; we cannot put any solids down the drains for fear of stopping the drains, and we might do as Mr. Ripley does under other circumstances.

11,655. Supposing you did pass the solid matter into the drains, and the drains were stopped up, who could remedy that mischief?—That I cannot speak to. It is a momentous piece of business when it comes, but I believe the town would have to do it if I could wait for them. We have done it ourselves; we cannot wait a minute. Sometimes they send a man or two to help us, but it has never occurred but twice, when something had got into the drain in bulk, and had stopped the drain up.

11,656. The charge of the drain appears to be a joint stock between you and the town?—Yes, I suppose it is.

11,657. From the manner in which you get your water, I presume that it is not polluted by any other dyer?—It is not, before we get it.

11,658. Do you go to much expense in pumping?—I take some water from the town as well.

11,659. How much do you take?—Not much last year, our men have not had much to spare, but sometimes we use perhaps 5,000 or 6,000 gallons a week.

11,660. Would you use more if you could obtain it?—Yes, if we could depend upon it; to get a large business and to be stopped is rather a serious affair.

11,661. Is the water that you get from the town suitable for dyeing?—Yes, it is.

11,662. More so than your own water?—No, it is not so good as mine.

11,663. What do they charge you for 1,000 gallons?—I do not know the scale for what we use now; but the lowest price is about 6*d.* per 1,000 gallons.

11,664. The scale is variable?—Yes, it varies from 1*s.* to 6*d.*

11,665. (*Chairman.*) What is the lowest scale of charge at Bradford?—According to the last list I saw I think it is about 2*d.* and a fraction for 30,000 gallons a day.

11,666. If you could have water supplied in bulk at 2*d.* per 1,000 gallons, would you use more?—Yes, if we could be insured of it.

11,667. (*Mr. Harrison.*) Do you go to much expense in pumping water?—No, but I have been at great expense in sinking and boring for it.

11,668. What expense have you incurred?—From 1,000*l.* to 1,500*l.*

11,669. To what depth did you sink?—About 20 yards.

11,670. Did you bore besides?—No.

11,671. Did you find much variation in the level of the water in your well at different seasons of the year?—Yes; just now I should think, in those springs, there would be something like 500,000 gallons a day.

11,672. What had you in the dry seasons, say the driest part of 1864 and 1865?—Perhaps 50,000 gallons.

11,673. At what time of the year do you find that you get the minimum quantity?—I should say it would be far into July or in August. If the weather is tolerably dry the springs will be as low then as at any time.

11,674. When do the springs fill and give you the largest volume of water?—This year they filled up very soon, because the rains came on early. It depends upon the rains. I am not well acquainted with the quantity that I have in the summer; we only finished it last autumn.

11,675. What arrangement have you in your works as to privies?—We have privies, and we mix the sewage with soil and use it for manure.

11,676. Upon your own land?—Yes.

11,677. Do you find benefit result from it?—Yes.

11,678. Do you remove it daily?—No, we have a heap of soil and we throw it over occasionally upon the refuse to keep it sweet; when there is any quantity collected we set some men to take it away.

11,679. Can you do that without causing any nuisance?—Yes, we never had a complaint from any one near us.

11,680. Nor is it any nuisance to yourself?—No;

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I live very near to the heap, and I never noticed it to be a nuisance.

11,681. Have you any waterclosets besides?—No, we live so near that we do not require them on the premises.

11,682. Have you lived long in Halifax?—Yes; this time I have been here about nine years. I left Halifax for 10 years on account of business.

11,683. What was the condition of the Hebble at the earliest time you can remember it?—In about 1831 it was quite different from what it is now, it is now a good deal worse.

11,684. Was the water in the Hebble suitable for dyeing purposes then?—Yes, I should say it was. I know of one dyer who used to wash in the beck, and I think that if he could do that he would be able to dye with it.

11,685. If you had been a dyer from that time to this should you consider that the pollution of the stream from that time had been injurious to your works?—Decidedly.

11,686. Therefore you think that the pollution having been allowed to go on has become an injury to certain dyers and others?—Yes, no doubt of it.

11,687. If the stream was restored to its former state would that be a boon to them?—No, by no means.

11,688. Why not?—Because if only one dyer was allowed to exist on the stream he would make the water in such a state that the others could not be very profitably employed.

11,689. But I mean supposing each dyer was obliged to purify the water before he passed it back into the beck?—He could not purify it so as that the other dyers could use it; if he turned it away it would deprive the other dyers in a dry time of water for condensing purposes.

11,690. Colonel Akroyd stated that by the use of lime, the solid matter being first separated and the liquid filtered, he had found it was quite possible, and within a small compass, to pass the water away from the works very nearly clear?—It is possible, I daresay, to treat a tumbler of water in that way, but to do that with what is used by all the dyers in Halifax would be a matter of great difficulty, the quantity upsets the idea altogether, here at all events.

11,691. That is to say there is no room for carrying out any mode that you have seen practised?—Yes; again lime would be more injurious to the dyers below than the colouring matter in the water. I do not believe that water is any better for being made to look better by chemical means of that description.

11,692. Do you use chemicals in your dyeing process, which apart from the colouring matter in the water would make the water, after it passes from your premises, unfit for other dyers to use?—Yes, decidedly, for general use; there are some colours that would make the water unfit for general use after we had parted with it.

11,693. Do you dye bright colours?—Yes.

11,694. How do you dry your pieces?—On cylinders heated with steam.

11,695. Used you formerly at any time to dry them in the open air?—That was a common practice here once, but it would not be done now; some dark colours might be so treated, but the atmosphere is hardly sufficiently good for fine colours and whites.

11,696. You find the smoke of the district disadvantageous in that respect?—I fancy so, but we should not use tenters now if we could. The cylinder system is quicker, and better in all ways. If there is to be any good done to the river above or below there is nothing like this, to get plenty of reservoir water to wash with. Filtering is under all circumstances a remedy that would be worse than the disease, there would be a regular pestilence.

11,697. Do you desire a reservoir in order to flush out the river?—Yes, to save the winter water for summer use.

11,698. You would diminish the winter floods?—Just so, but the winter floods would still be sufficient to do a deal of mischief if we may judge from yesterday.

11,699. Is not that rather an exceptional case?—Yes.

11,700. Your remedy is to increase the reservoir room and increase the steady supply of water; and further, you would prefer that the pollution should be allowed to pass into the river?—Certainly; but it is not for me to say anything, because I could scarcely divest myself of selfish considerations; but situated as I am, I certainly should say so.

11,701. If it could be shown that you could purify the water, as Colonel Akroyd has suggested, in a small compass, without any great trouble or expense, do you think it would be fair to call upon the manufacturers to carry that out?—That is another point. I believe that the 900 waterclosets in Halifax require us dyers to prevent a regular nuisance and pestilence. I believe that the acids we send down are a great deodoriser of the stream, and that but for them, the stream should be in a worse condition than it is; and to divest this water of these deodorisers, and to continue to allow the sewage to run into it as it does from the town, I think would create a considerably greater mortality than there is. Therefore I believe that we dyers are great benefactors to the country.

11,702. But if the sewage is not sent into the stream your assistance will not be wanted?—I do not think there is any system by which that water can be purified.

11,703. Supposing that the corporation determine to carry the sewage of the town on to the land and to utilize it there, but find that your dye waters are an injury, and make the sewage of less value for agricultural purposes, they may turn upon you and say, "We cannot allow you to pass your waste liquor into "the sewers: you must take some steps to purify it." What would you say to that?—There would be no way but to call the acids alkalis; they would not interfere with the sewage. I believe that even sewage applied on land would make the country very unhealthy unless deodorisers are employed with it. I think that we dyers will be required to some extent, even in a sanitary point of view; the town authorities must use something to fix the bad gases, and I think we do that now, and the moderate quantity of stuff that we turn out would be useful as manure.

11,704. The further that is carried, of the less value in all probability you would make the sewage as manure?—Yes, there would be a little too much certainly.

11,705. Sewage is undoubtedly a valuable article if properly applied?—Yes.

11,706. It does not appear to be the best way of overcoming any practical difficulties that there may be, to diminish the value of the sewage?—No; as far as I am concerned I should have to shut up my works, I could not do anything. I have not room, and there are many dyers situated like me.

11,707. It might be otherwise, if you were shown a way of doing it within a small compass?—You cannot do it. Lime will cure the evil to some extent. I am aware of that; we use lime, but at the same time the water is worse when the lime is put in; it is cleared to some extent, but it is no better than it was before for general purposes.

11,708. How is that?—Because the lime is very detrimental to us as dyers.

11,709. But not to the manuring properties of the water?—Not much so.

11,710. (*Chairman.*) Did you hear some questions put as to the prevention of throwing ashes into the river; I suppose you would say that some plan might be carried out?—Yes; I believe there ought to be a law in this town to prevent it. It can be prevented.

11,711. Would it be beneficial if the river margin were protected and the bed of it improved, so that the sediment should be gradually passed away, and not allowed to accumulate?—Yes.

11,712. You do not see your way to extracting the

colours from dye water, and you think that a mixture of chemical ingredients combined with the colours cannot possibly be injurious to health?—Yes.

11,713. As far as you understand chemical processes, you think that if means are devised to extract the colouring matter by some chemical process, the water might be made brighter in appearance; but that it would be in reality more unfit for any purpose that you wanted it for?—It would be less suitable for any manufacturing use.

11,714. It is quite possible for a bright water to be foul and unfit for dyeing purposes?—Yes.

11,715. You might have a bright looking water that would be more injurious than a dirtier water that had not any chemical ingredients in it?—Just so. Water that is slightly coloured will do for dyeworks, but water is more plentiful now on account of the town supplying water. We used it to take the beck water at Bradford to dye colours with; we were compelled to do so or else we should have had to shut up our works for want of water.

11,716. You, as a dyer, would be willing to do all that was practicable to prevent the river being obstructed by solids?—Decidedly, I think all that ought to be done.

11,717. You do not see your way to any practical interference to compel you to abstract the colouring matter?—No.

11,718. You think that it must go down the stream as it does now?—Yes.

11,719. And although the water may be discoloured you believe that it will not be injurious to health?—Yes.

The witness withdrew.

Mr. Joseph Travis Clay (Rastrick) examined.

Mr. J. T. Clay.

11,720. (*Chairman.*) Are you a resident in the borough of Halifax?—No. I live at the extreme eastern boundary of the parish.

11,721. What trade do you carry on?—I manufacture the finest fancy cloth.

11,722. Is it made from wool or from a combination of wool and cotton?—It is principally worsted; very fine worsted and some foreign wool.

11,723. Your works are situated at Rastrick, I believe?—Yes.

11,724. How far distant from the town-hall?—About four miles.

11,725. Upon what stream are they?—It is a very small stream which runs into the Calder opposite to Brighouse.

11,726. What number of hands do you employ?—About 80 on the premises.

11,727. Do you use any kind of water or steam power?—We use steam power, large boiler power, but small engine power—about 50-horse boiler power and about 12-horse engine power.

11,728. What weight of coal do you burn per annum?—About 600 tons.

11,729. What do you do with the ashes?—We throw them out, and there is generally plenty of demand for them, for mending roads and making footpaths.

11,730. Do any of them find their way into the stream?—Not any; indeed the stream is too small to carry any.

11,731. Have you any form of refuse from the manufacture besides the ashes?—There will be a good deal of dirt in solution.

11,732. With the water?—Yes.

11,733. What volume of water do you use in a day? It is very difficult to state the quantity; the bore-hole supplies about 7,000 gallons a day, and then we have a small stream of water coming down, and that stream varies very much in quantity; we use all the water whether little or much.

11,734. Do you get water from any other source besides the stream?—The stream and the bore-hole.

11,735. What depth is that bore-hole sunk?—About 40 yards.

11,736. What do you pump from it?—It raises to the surface about 7,000 gallons a day.

11,737. Of what diameter is the bore-hole?—About three inches.

11,738. What is the quality of the water?—It is a little harder than the surface water.

11,739. You can use it for your work, but it is a little hard?—Yes, it is a little hard; the surface water is very good.

11,740. Does the bore-hole water vary in volume at all at any particular times of the year?—Last summer it was rather less, but taking it generally it is very uniform.

11,741. It flows uniformly over the surface into the reservoir?—Yes.

11,742. Do you dye on your premises?—Yes, a good deal.

11,743. What weight of materials do you dye per annum?—We do not dye a great weight; it is very fine material, and the weight is not very large; I cannot give you the particulars.

11,744. Do you use soap?—Yes, a considerable quantity.

11,745. And oil?—We use about 5 cwt. of soap a week, and there is a little oil with the yarn. The principal part of the material that we use we buy in the spun state in the yarn.

11,746. What becomes of the soapsuds?—They run down the watercourse.

11,747. You do not so deal with soapsuds as to attempt to extract the soap?—Not at all.

11,748. Would it not pay?—It is impossible to extract the soap from an immense quantity of water in comparison to the soap that is used.

11,749. Because the soap is so much diluted?—Yes.

11,750. Have you ever tried what effect the soap waste would have on grass land?—We have no grass land below us over which we have any power. From the peculiar stratification of Rastrick it is perfectly impossible to attempt anything of that sort without injury to other parties.

11,751. Is the place so thickly peopled below you? No, but the water supply to the village is from wells, and the surface of Rastrick is on the flagstone series; it rests on a bed of shale, which is perfectly impermeable to water, and if dirty water is thrown upon the surface it sinks into the wells and pollutes them.

11,752. Do you obtain water from your bore-hole from the flagstone?—No, below it. The water sinks through the flagstone and runs out at the point of the junction of the flagstone and the shale.

11,753. Therefore all the wells derive their water from the same level almost?—The same geological level.

11,754. The same outcropping?—Yes.

11,755. Has there never been any attempt made to utilize the soap refuse from your manufactory or any other in Rastrick?—Not at all. I may say that the manufacturing operations in Rastrick are only small; there are only four mills on the stream, two above me and one below me.

11,756. How far down have you ever noticed the effect of the water refuse of the district?—Until it joins the Calder.

11,757. Is the water discoloured all the way down?—Yes.

11,758. It does not lose its colour?—The distance is too small. The whole length of the watercourse from the highest mill to the Calder is about a mile and a half, and the stream is very rapid.

11,759. It flows and disappears in the Calder?—Yes; there are 400 feet of fall in one and a half miles; the water rapidly runs away.

11,760. Have you any refuse dyewoods in a chipped or rasped form?—A small quantity; we burn the dyewood.

11,761. Chipped and rasped as well?—Yes.

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11,762. Have you any smoke prevention apparatus in any of your boilers?—No.

11,763. Do you pass thick smoke into the atmosphere?—Yes, occasionally.

11,764. Did it ever occur to you to try to prevent the loss of fuel by preventing smoke?—Yes, we have tried various schemes at different times.

11,765. Have they not answered?—No. I have just put another boiler down to have abundance of boiler room, and I believe that that is the best means we can adopt.

11,766. If it can be shown that by careful firing the smoke can be prevented, should you consider it a great hardship if you were compelled to make your men fire more carefully?—No, I do all I can now to effect that.

11,767. And perhaps you would not like to be interfered with?—I would rather not.

11,768. Would you rather continue to make smoke?—I would make as little as I could help in any case.

11,769. If a regulation were made that no manufacturers should make smoke, or that they should use the best means they could to prevent it, do you think that would be a great hardship?—If it could be done I would do the best I could to accomplish the purpose.

1,770. Have you privies or waterclosets on your premises for the workpeople?—There are four privies and one watercloset which is very little used.

11,771. Do you do anything with the refuse?—It is mixed with ashes and carried on to the land by farmers.

11,772. You do not pass it into a sewer?—No.

11,773. I suppose there is nothing to prevent any manufacturers establishing themselves on the stream?—There is not sufficient water for any more manufacturers on that stream; it is as fully occupied as it can be.

11,774. You think that it is used up?—Yes.

11,775. Then you are living with the idea that you will not be interfered with by any person above you?—I may say that previously to 1857 we had no mills above us. At that time two mills were established. There was a dyehouse formerly, and we found great difficulty from its fouling the water. We had two lawsuits which went to the assizes about that matter. In 1857 two mills were erected which discharged a great quantity of refuse into the stream. I complained about it. I threatened proceedings, and the owners and occupiers now bring us clear water from some springs, and we allow the refuse to come down the watercourse without complaining, so that the whole of the clear water which can possibly be obtained is taken.

11,776. Then you have arranged amongst yourselves as to pure water, and you have also arranged that the polluted water shall pass down into the main stream?—Yes; we use the polluted water for condensing purposes for the boilers, and the pure water from some of these springs supplies us with water for dyeing and scouring.

11,777. Were these lawsuits gone on with?—Yes, two were gone on with.

11,778. What did they cost you?—The law suits were before my time.

11,179. But I suppose that lawsuits are occasionally rather costly?—There is a gentleman in this room who can tell much better what they cost than I can. The last lawsuit which we had, I think, was in 1823.

11,780. Do you think that, as the law stands now, there is a liability of individual millowners getting into quarrels and disputes and into lawsuits with regard to these water rights?—Certainly, a very great probability.

11,781. And do you think that it would be an advantage if there were some superior tribunal to settle what should be and what should not be without all this great cost?—I do not see any tribunal except the courts of law of the kingdom; I do not see how any special tribunal could be instituted.

11,782. Do you not think that a conservancy could be established which should have jurisdiction and authority over the river basin, so as to lay down general rules and bring all manufacturers into one order of proceeding?—If I had been supplied with water for an indefinite length of time, I should not be disposed to submit my rights to the arbitration of any conservancy, and I should much prefer the courts of justice.

11,783. The common law of the land?—The common law of the land.

11,784. Supposing that your stream was a little larger than it is, and that it would enable half a dozen more dyeworks or mills to be established above you, and that those individuals chose to use that stream for every purpose which they thought an advantage to themselves, throwing their ashes, besides solid refuse of every other kind, and divers forms of pollution, into the river, would you rather be in a condition to indict them, and to fight the matter out, than simply to appeal to a board which could stop them in an instant?—I should be very glad if there was a board which could stop them in an instant.

11,785. And a board which could not only stop them, but compel them to do something which would be not only for the benefit of themselves, but greatly for your benefit?—But any powers which that board could exercise must devolve upon them by some law of the land.

11,786. Of course Parliament must devise a new law. At present all you gentlemen in Yorkshire do just as you like?—I cannot quite agree in that.

11,787. Is it not so?—You, I daresay, know other districts besides your own. Is it the fact that the rivers are polluted?—Very greatly.

11,788. Is it the fact that that pollution has grown up within the last 20 years?—Very greatly indeed.

11,789. Is it the fact that as trade increases, and more work is done, that pollution will increase?—Yes.

11,790. Is that a desirable state of things?—By no means.

11,791. Can the common law stop it?—I cannot answer that question.

11,792. Do you think that it can?—I think that it scarcely can, because it would be so difficult to fix the blame upon any particular individual.

11,793. You have a thousand people committing a nuisance, and you have one person single-handed to sue them?—Yes.

11,794. Is there any chance of success there? Supposing that you are situated below Halifax, you have to face the borough of Halifax and all the inhabitants of it, whatever nuisance they commit upon you?—I decidedly think it necessary that there should be a means of protection.

11,795. Do not you think that a conservancy board would be no more afraid of the borough of Halifax than it would be of the simplest manufacturer in the district? It would have authority to interfere with the largest proprietors or any number of the largest proprietors, and the machinery would be as simple to deal with them as it would be to deal with an individual?—It would depend upon the constitution of the Board.

11,796. Do you not think that if a conservancy board were formed it should be formed of representatives of suitable interests?—That is the great difficulty.

11,797. But things which are difficult are not impossible?—Certainly not.

11,798. Do you not think that you would be using your time very profitably if you for a short time thought of that point, and if, when the question had to be discussed, you tried to make the board an efficient one?—I have thought a great deal about the subject of pollution of rivers.

11,799. But yet you have come to the conclusion that you would rather be left alone?—I would rather be left alone personally, that is all.

11,800. Could not you divest yourself of a little of that selfishness (I do not use the word offensively—we are all of us selfish), and look at the question a little more broadly?—I have made my answer upon that assumption.

11,801. A man should work for himself, but he should also work in a broader and more catholic spirit, and should see that there are other persons besides himself. True self interest is that which considers the welfare of the state; selfishness is so developed into philanthropy?—With respect to the pollution of the river, I think that it is quite impossible to look to the river being made perfectly pure.

11,802. We will not consider absolute purity, but what is a practical improvement. If 20 tons of solids are thrown in what do you say?—They should not be thrown in.

11,803. But persons say that they have done so for 50 years, and that they have a right to do it?—I cannot conceive how a person can have a right to throw solids into the river. My opinion is that all solid matter should be kept out of the river. It is perfectly impossible to keep out foul water holding certain matters in suspension.

11,804. You mean the dye matters?—Yes, the liquor.

11,805. Supposing that all matters in suspension are kept out, the water in itself would never become offensive, would it?—No.

11,806. It is the solid part which is offensive?—Yes, the offensive portion arises chiefly from the animal matter contained in the wool.

11,807. That animal matter, the oil and the grease, can be taken out, and is taken out to a great extent?—A certain portion is taken out.

11,808. Do you know that the manufacturers of Yorkshire at this moment are receiving not less than 100,000*l.* a year for waste products from washing water?—Yes, some manufacturers may be receiving a large sum of money, and other manufacturers may not be able to receive a farthing.

11,809. We have an estimate from very competent persons that 100,000*l.* a year, namely, 2,000*l.* a week, is now paid back for the refuse which formerly passed into the river?—In the case of certain manufacturers the soap is capable of being extracted, as they let out their soapsuds in such a state that it can be done, but other manufacturers, of whom I am one, send out their soapsuds in such a diluted state that it is impossible to restore the soap.

11,810. It would be impossible to restore the soap so as to pay you a profit?—I believe that it would be physically impossible.

11,811. That is a question of chemistry. We have competent authority for stating that 100,000*l.* a year is paid for the waste soap recovered, but the same authority of his own knowledge says that soap to at least the extent of another 100,000*l.* a year is carelessly passed into the river, which could as easily be recovered as that soap which is now recovered?—Suppose that I have 1 lb. of soap in 1,000 gallons of water, or even 100 gallons of water, I say that it is impossible to restore it.

11,812. It is not impossible; if you mean impossible abstractedly I say no?—All things are possible.

11,813. That is possible at all events, mechanically, because, without being a chemist, I may tell you that I could by boiling evaporate away all that water, and leave a residuum at the bottom, but I do not state that it would be possible practically?—I am merely speaking of it practically.

11,814. If chemistry can discharge (which it does) soap from a certain volume of water, it is not fair to say that because the soap is more largely diluted, it is impossible to take it out; it may not be practical as a paying concern, and it may not be advisable?—We wash our pieces beginning with their being dirty, till the water comes out quite clear, and therefore it is in every state of dilution.

11,815. Suppose that you had a tank of the size of this room, and that you were obliged to pass all the refuse water in so that the sediment should go out at the bottom, and that the water should flow out at the top?—That would be a very good plan where people have room; if the effluvium were not a nuisance, which it probably would be.

11,816. What is to prevent your being made to have room?—Because I could not find it. I could not extend my works an inch in the direction which would be required for that purpose.

11,817. Of course I do not know what the works are?—I am now speaking of old works. I entirely agree with you that in all new works something like what you have described would be most advantageous, but my works have been in operation for from 60 to 70 years, and other works of the same kind in Halifax are in a circumscribed position. A dyer or manufacturer may not have another inch of ground which is not appropriated, which is my case, and therefore he could not make those tanks.

11,818. And do you say that he has no money to buy any land outside?—We come immediately upon a turnpike road.

11,819. There is land upon the opposite side of the road?—Yes.

11,820. And I suppose that a pipe of 4 inches diameter would carry the refuse water from your works anywhere?—Yes; I should be very glad if everybody was made to do it.

11,821. (*Mr. Harrison.*) Would you object to do it if all others were made to do it?—No, because it would be a very great benefit to me if my neighbours above me would do it; it would be of far more benefit to me than the cost of my having to do it myself.

11,822. (*Chairman.*) If there was a general conservancy board, and you said to them, "I cannot "carry out these regulations of yours, because there "is no room on my premises." Either you might individually go where there was room, or the conservancy board might say to you, "We see that you have "not room here, but we, under our powers, will take "your soapsuds and your refuse water to a place "where there is room, and combine them with those "of other manufacturers, and they shall be dealt "with; and it will cost you so much per annum; "we will ask you to pay for what you cannot do "yourself, and we will do it for you?"—It would be a very capital thing.

11,823. When we are speaking in that way, I am only supposing that it would be something which you could afford to pay. If the refuse is now costing you nothing as you are wasting it, you might not like to pay 50*l.* a year for it, but if every other person in the same trade and similarly situated were put under the same restrictions, it would then be a matter of arrangement between you and the general public, and you would have to charge so much more for your dyeing?—So far as I am personally concerned, I should be very glad if it could be done; it would be a benefit to me, inasmuch as I should receive all the water from the beck in a state fit for use.

11,824. Is there anything which you would wish to add to your evidence?—I was summoned here to give evidence as to the Rastrick stream, and now that I am here, I should like to say a few words upon the state of the Calder, which is the principal stream. The Calder skirts Rastrick for about two miles, and within the last 20 years it has amazingly increased in foulness. About 20 years ago it was a very pure stream, plenty of trout were caught in it, and it was a very great amusement to the weavers to go and fish there; but now there is nothing of the kind to be seen. I have made a few memoranda respecting the Calder, and I have arrived at much the same conclusions as those which you have indicated, that is to say, with regard to the corporation of Halifax, which I consider to be the great sinner in the neighbourhood, I think that they ought to provide means to catch the solid part of their refuse before they send it into the Calder. My idea with regard to this question generally is, that we must abandon the Calder as a source of pure water, and that everybody should be compelled to retain all solid matters, so as to render the Calder innoxious to the health and comfort of the people; and that we must look to the higher ground in the parish for a supply of pure water for

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manufactures. The Halifax corporation, as you have had evidence, are making very large reservoirs, and I consider that to be the direction to which we must look for a supply of pure water. The enormous rainfall which there is in this neighbourhood would provide plenty of water for every purpose, without interfering with the volume of water required to cleanse the river.

The witness withdrew.

The witness subsequently forwarded to the Commissioners the following letter:

Rastrick, near Halifax,

GENTLEMEN, Nov. 22d, 1866.

IN reference to the evidence which I had the honour to give before the Commission on Saturday last, I beg leave to hand to you the result of experiments made to ascertain the proportion of solid matter in the refuse poured into the stream from worsted dyehouses.

1st. I took 6 oz. = 2,625 grains of soapsuds of the ordinary strength and evaporated to dryness. The result was 6 grains of solid matter or $\frac{1}{437\frac{1}{2}}$.

After scouring with soap the goods are washed in pure water, and I calculate the proportion of soap to the whole of the water passing through the machines as 1 in 800.

It must be noted that the animal matter had been removed from the wool in the first operation by the spinner, and no doubt the product was sold.

2nd. I took the same quantity, say 2,625 grains of the decoction of logwood chips after the dyeing process was completed, evaporated to dryness, and found a residuum of 7 grains or $\frac{1}{375}$. This refuse as discharged into the stream is of a dark claret colour, and tinges a very large volume of water, so that a casual observer could scarcely credit how small a portion of solid matter is contained therein.

I have the honor to be, &c.

(Signed) J. TRAVIS CLAY, F.G.S.

To the Rivers Commission. &c. &c. &c.

Mr. J. W. Child.

Mr. JOHN WRIGHT CHILD (Halifax) examined.

11,825. (*Chairman.*) Are you a resident in the borough of Halifax?—Not in the borough, but in a district immediately adjoining.

11,826. Do you carry on any form of manufacture?—Yes, Mr. Akroyd's, not my own.

11,827. Where are the works situated?—At Copley, on the bank of the Calder.

11,828. What is the business?—Worsted spinning principally.

11,829. Are they the same works as Mr. Akroyd spoke to yesterday?—A portion of the same; he was principally speaking about Bowling Dyke, which is within the borough; these works are not in the borough but about half a mile outside of it.

11,830. What number of hands do you employ?—About 850.

11,831. What horse power do you use at those special works?—About 120 nominal steam, and an average of 30-horse water power.

11,832. What weight of coal do you consume per annum?—About 3,000 tons in a year for the engines.

11,833. What do you do with the ashes which you make?—We bury them.

11,834. You do not pass them into the stream?—No.

11,835. Have you waterclosets or privy accommodation?—Privies entirely.

11,836. What do you do with the refuse?—We take it away.

11,837. You do not pass it into the stream?—No.

11,838. Do you dye and wash?—We do not dye, we scour.

11,839. What weight of soap do you use per annum?—Only a small quantity; we only wash about 25 packs a week there; of soap and alkali together we use about 800 lbs. a week.

11,840. Do you use any acids?—No.

11,841. Any oil?—Only a very small quantity.

11,842. What volume of water do you use per week?—For condensing purposes about 470,000 gallons a day; nearly the whole of that is returned into the river in the same state, with the addition of a little heat; about 3,000 gallons of it would be used for scouring purposes.

11,843. You have obtained water from the river entirely?—Yes, with the exception of a small spring for domestic purposes.

11,844. Then you do not obtain any from the waterworks?—No.

11,845. What becomes of the waste refuse from the soap washing?—It is sent into the river.

11,846. Do you utilize any of it?—No.

11,847. Is it too poor for you to utilize it?—The quantity is too small to pay for the capital which would be necessary to convert it.

11,848. If there were general regulations as to the stream, would you object to being made to purify that small volume?—Business people do not often wish to do anything at a loss. I may say that there are works for the conversion of soap, within a few hundred yards of the place, but they will not take away our refuse suds even at a gift.

11,849. Supposing that the extraction of soap from your water involved a loss, but not any very serious loss, do you think that it could be done?—Yes.

11,850. Or suppose that you had sediment tanks and extracted the soap by letting it fall down and letting the effluent water pass away?—I should not like a nuisance of that kind about the place, exposed to the sun and the air.

11,851. Is it a fact that soap waste when it becomes stagnant is very offensive?—Yes.

11,852. Then any deposit from that soap waste in a river as large as the Calder, if subsequently exposed on the banks, would be liable to become corrupt and a nuisance?—Yes, if it was exposed on the banks; but if the dilution was sufficient I do not think that it would be so.

11,853. Do you know in what condition the Calder is in a very hot summer and in dry weather?—It is much worse than it used to be.

11,854. Are noxious gases given off upon the banks?—I think not; the banks are too steep; it may be so lower down the valley.

11,855. I suppose that the general pollution of the Calder is made up of littles?—Yes.

11,856. And every item which is added is an addition to the pollution?—Yes.

11,857. And the prevention, as far as practicable, would have to be applied to both small and great?—Yes.

11,858. Do you use any means at your works to prevent smoke?—Not at present; we did sometime ago, but we did not find it very effectual.

11,859. Did you use any patent?—Yes, Jukes's.

11,860. Why did you discontinue Jukes's patent apparatus?—On acconnt of the trouble which there was with it.

11,861. Did it give you the power which was required?—No, we had to press it.

11,862. To force it?—Yes.

11,863. At present does your chimney send forth smoke considerably?—No, not in proportion to the quantity of coal used. We have plenty of boiler room, and we give the men directions to be as careful in firing as they possibly can be. I think that if the men fired more frequently, and with less coal at a time, and allowed a fair admixture of air, according to the quantity which they put on, it might be better still.

11,864. Then, I suppose, that any general regulation which put all manufacturers under the same restrictions would not be obnoxious to yourself?—No.

The difficulty is in making the workmen attend to orders.

11,865. The authority would have to interfere with you, and not with the workmen?—Yes; I do not see any other way.

11,866. You would not like any external authority to step between you and your workmen?—I think that it would not be advisable.

11,867. But any general interference must be with the manufacturer, and he must find means to interfere with his workmen?—Yes.

11,868. How long have you known the Calder?—25 years.

11,869. In what condition was it when you first knew it as compared with its present condition?—It was more clean than it is now; of course every dwelling house and every manufactory established on its banks makes it worse.

11,870. Then, as the country increases in manufacturing and commercial wealth, if things are left as they are the river is likely to get more foul?—I do not think that that is a necessary consequence. If, at every manufactory which was set up, and at every dwelling house which was set up, there was a sufficient supply of water independent of the stream, that is to say, from waterworks, I do not see that the pollution would increase.

11,871. Do you think that if the district is left alone there will be an improvement, or that it will be as heretofore, that with an addition of population there will be an additional pollution?—I think that it is very likely that pollution will increase. I do not see any mode of remedying it except by an additional supply of water.

11,872. Do you think that the establishment of these reservoirs, and the bringing in of an additional supply of water, sufficiently dilutes the polluted water—I think that it is the most practical mode of dealing with the matter.

11,873. It does not get rid of the pollution?—No; I do not see how the fine matters held in suspension, such as the colouring matters, or matter held in chemical solution, can be got rid of. I think that a general law prohibiting heavy matters, such as ashes and dyewood, being thrown into the stream, would be generally acceded to, and carried out.

11,874. But you think that if the dyers and printers and manufacturers generally were told that they must restore the streams and rivers to a state of purity, it would be impracticable, and would be resisted?—I think so. It would be impracticable. It is possible to filter the water, and to send it into the river perhaps in a clear state, but still all the matters chemically in solution must pass so far as I know.

11,875. Have you ever tried any experiment with a smaller quantity of water, allowing it to settle and seeing what became of it?—I have not. We do not dye at all.

11,876. Are you aware that the great mass of the colouring matter is not chemically combined with the water, but is mechanically suspended in it?—It is mechanically suspended to some extent, I think, but not entirely.

11,877. Is not that proved on a grand scale in your rivers, because as they flow downwards by exposure to the sun and the air, and the earth forming the bed of the river, the water loses its colouring matter as it goes to the sea?—Yes.

11,878. Showing that it is not a chemical but a mechanical combination?—It may show that, but I think that some reformation of matter takes place, and that the improvement may not be entirely owing to the process of filtration.

11,879. The action of the atmosphere has a great influence in bleaching matters in water?—Undoubtedly.

11,880. You say that you have never made any experiment with dye waters; you do not dye?—We do not, and I have not tried the experiment. I merely say that some of the colouring matter must be in chemical solution, or otherwise it would not permeate the whole fibre of the wool for instance.

11,881. There are chemical ingredients put in which no doubt enter into chemical combination, and which are inseparable, except by evaporation?—Yes.

11,882. (*Mr. Harrison.*) Did you hear Colonel Akroyd say yesterday that he had tried an experiment with lime?—I did not hear his evidence yesterday. I have heard him speak about it.

11,883. He stated it as his opinion from certain knowledge, that the application of lime would separate the solid dye matters which were in suspension, and leave the water very nearly bright, and that by means of a simple filtering apparatus all that solid matter might in his opinion be separated, and the water allowed to pass off very nearly clear?—Perhaps it might be done, the lime would take up the acid.

11,884. Do you think that it would be a right thing to provide that that should be done?—Yes, as far as it was practicable, but I think that on a large scale it could not be carried out.

11,885. (*Chairman.*) Have you anything to add to your evidence, or any remark to offer?—No, except on the matter of conservancy. As I have said before, I think that throwing heavy matters into the river would not be done by every one, but would be done by some people, whereas a law to prevent it would be obligatory.

11,886. A conservancy would have jurisdiction over the entire river area, to put everybody in the same situation?—Yes, as far as regards solids.

11,887. And to carry out improvements in the river and its tributaries?—Yes.

11,888. Do you think that some of the tributaries might be materially improved by having their channels straightened, and their beds deepened and cleansed?—Perhaps they might. Such a flood as we had yesterday, or any flood in the winter does that.

11,889. But it does it with a considerable amount of mischief occasionally?—Yes.

11,889*a*. Floods are rather wayward?—Yes.

11,890. They do not respect either persons or property?—If all the water which has fallen upon the hills during the last few days could have been stored there, it would have been a considerable quantity.

11,891. (*Mr. Guy.*) I should like to make one observation. I saw that some complaint was made immediately above my works, and that it was said that there was a considerable effluvium. It was caused simply by an obstruction in the watercourse, so that the water, instead of running down at a rapid rate, was retained, and it made this disagreeable smell. If what would be called a sud pond was made immediately below, that evil would be always in existence.

11,892. (*Chairman.*) You think that the remedy in that form would be worse than the disease?—Yes.

11,893. (*Mr. Harrison.*) But the water from your works flows into the Calder?—Yes.

11,894. And it carries that refuse with it generally?—Yes.

11,895. In the lower parts of the Calder there are works, and during a droughty season the refuse is exposed upon the banks of the river, and it is found to be a nuisance to people residing in the neighbourhood, therefore the nuisance which you have experienced at your own particular dwelling is actually experienced by many people lower down the river, almost everywhere, showing that under the present system the remedy is deferred?—Yes, everybody wants to get rid of the nuisance by giving it to someone else.

The witness withdrew.

Mr. Frederick William Cronhelm (Halifax) examined.

11,896. (*Chairman.*) What business is carried on at your establishment?—The name of our place is Canal Mills; it is chiefly a woollen mill, it is also a worsted mill. We have likewise a dyehouse and finishing works. In short we receive the wool into the works at one end and send out the finished goods

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in bales at the other. We have a complete arrangement for the manufacture and the finishing, including the dyeing.

11,897. Where are the works situated?—Close to the canal.

11,898. What is the canal known as?—It is the Calder and Hebble Navigation.

11,899. Do you use the water of the canal for your manufacturing purposes, or merely for traffic?—We use it partially when we are very short of water. We have permission to use it, but we refrain from using it as much as we possibly can, inasmuch as the water is not so pure as we get elsewhere.

11,900. What number of hands do you employ at your works?—The whole number is about 500, more or less.

11,901. Have you steam power or water power?—Only steam power.

11,902. Do you know what power you employ?—You are aware of the distinction between nominal horse power and real horse power. We have three steam engines, and the nominal power is 120 horse, but we consider it fully equal to double that, or 240 horse.

11,903. What weight of coals do you consume per annum?—In preparing to answer this question, I took the average of several years, and I found the average to be 4,500 tons.

11,904. What do you do with the ashes from the consumption of that coal?—I must explain to the Commissioners the position of our works. Part of the works are on the north side of the canal, close to the canal; on the other side of the canal we have the dye-house, the duling room, and the finishing works; those are situated between the canal and the river Calder. Then eastward from our works we have a large holme, which lies very low, and in flood times it is a complete lake, as was the case yesterday. We endeavour to raise the level of this holme so high that any extension of the works eastwards should not be subject to floods or encroachments from the river, therefore all our ashes are brought on to this holme, and we gradually cover its surface and elevate its level.

11,905. Have you at all protected the water so that the ashes shall not fall in, or be washed away by flood waters?—Entirely so.

11,906. You do not pass them into the watercourse?—Not at all; we take them in carts from the furnaces, and spread them upon the holme.

11,907. Have you privy accommodation or water-closet accommodation for your hands?—We have both.

11,908. Does any of the effete matter pass into the streams or rivers?—No.

11,909. You utilize it?—Yes, it is carried away to a manure heap.

11,910. It is not passed into the stream?—No.

11,911. Do you carry on dyeing upon the premises?—We do.

11,912. Do you use dyewoods of various kinds?—We do.

11,913. Logwood and other woods?—Yes.

11,914. Do you use them in the chip and in the rasped state?—No, they are all in the ground state.

11,915. Do you extract the solid matter from the dye refuse before passing it down the stream?—There is very little solid matter left in the dye water, which passes into the river Calder, only the crude particles of the ground wood.

11,916. What weight of wood do you use per annum?—I am sorry that that question was not in the list of printed questions sent to me.

11,917. Do you use besides the dyewoods any chemicals, acids or alkalis, or soap?—Yes.

11,918. Do you know what weight of soap you use?—Neither the soap nor the oil is mentioned amongst the questions which I was appointed to answer.

11,919. Do you utilize any of the soap refuse?—Yes, the soapsuds are restored to oil, and to a tallowy kind of matter.

11,920. Do you know what is paid to you per annum for the recovery of your soap waste?—Yes, I can tell you that to a penny, because we do not carry on the operation; we let it.

11,921. And the party to whom you let it pays you a rental for it?—Yes, there is a person who takes the soapsuds of several manufactories in our neighbourhood in the same way.

11,922. What does he pay you?—He pays us 60*l.* per annum.

11,923. You have not a very large weight of soap? No; the nature of our fabrics is such that they do not take so much soap.

11,924. How long do you remember the state of the canal and the rivers near your works?—About 70 years.

11,925. In what condition were they when you first knew them as compared with what they are now?—They were much purer than they are now. I remember when I was a boy fishing in the Calder, and it was a very great amusement for me, and I frequently caught fine trout and other fish, but now there is an end to all that.

11,926. Is the canal more impure than it was when you first knew it?—Undoubtedly so.

11,927. Do you think that it is still becoming more impure?—I consider that it is.

11,928. Is it a nuisance in dry weather as regards its smell?—The effluvium from the canal in dry weather is very offensive.

11,929. Have your workpeople ever complained of it?—Yes, they have observed it more or less, especially those who reside in cottages near.

11,930. Where do you get the water which you use for your manufacturing processes?—We get it partly from a large reservoir which we have in Skircoat above the works on the hill side, and partly also from a pump which pumps the river water into a cistern, not immediately from the river near us, but from what is called the Stannard; the stream of water permeates the river bed much higher up, and flows along what was formerly the bed of the river; there is a pebbly stratum over which it flows.

11,931. And you get your reservoir partially filled in that way?—Yes, it is certainly purer than the water on the banks near the works.

11,932. Have you any water supplied by any company, or from any artificial waterworks?—No; we have contemplated in droughty weather applying to the Halifax Company for a supply, but we have not yet availed ourselves of it.

11,933. Do you at any period sludge or cleanse the reservoir upon your own premises which belongs to you?—The great reservoir has not been cleansed or sludged more than once in a great many years.

11,934. Where did the refuse pass when you cleansed or sludged it?—It was flushed out by water into the canal; the canal is between our main factory and the reservoir; the river Calder is on the other side of our dyeworks.

11,935. What do the canal people say to you?—We never heard any complaint from them.

11,936. Do they dredge the canal by dredge boats?—They do.

11,937. Then any solid matters passed in would have to be dredged out by their dredge boats?—Yes; I very well recollect that the dredge boats have been long at work immediately opposite our works, and I think that they dredge about once a year.

11,938. Do you carry largely upon the canal; are you good customers to the canal people?—We are; we get the whole of our heavy materials, the whole of our coal, and a large portion of our oil by the canal; we contribute largely to the dues of the canal; we think that the canal people do not consider that sufficiently. I will tell you in what respect. For the better carrying on of our works we have several galleries or covered bridges between the great mill, which is on the north side of the canal, and the dyeworks and finishing works on the south side of the canal. I think that we have five or six bridges and covered galleries, and they have latterly began to claim a rate for the privilege of erecting these struc-

tures over their canal, though they do not in the least interfere with the navigation.

11,939. The canal company, I suppose, wish to have the right of stopping them if they choose ?—Yes, we pay them 10*l.* a year as bridge rent.

11,940. They would not have been content with 10 peppercorns ?—No.

11,941. (*Mr. Harrison.*) You say that you remember the Calder in former years in a very much purer condition than it is in now ?—Certainly.

11,942. Have you observed any difference in the bed of the river; has it risen at all ?—Very materially indeed. Besides our other mills we have two large mills higher up, called Mereclough Mills, one being Mereclough in Norland, on the south side of the Calder, and the other Mereclough in Skircoat, on the north bank of the Calder. The water power is exceedingly valuable; the Weir forms a river dam. We find that dam so materially filled up that I believe the water power has been reduced more than one half as compared to what it used to be. The depth at the weir head instead of being from 4 to 6 feet has, I believe, at times been reduced as low as 2 feet.

11,943. What is the character of the materials which you find in the bed of the river causing that raising ?—There is a variety of materials; great abuses are committed; ashes are thrown into both the river Calder and its tributaries, and all that is so cast into the tributaries goes into the Calder. But the greatest nuisance which we have found has been from the chemical works which are very near.

11,944. Where are they ?—There is only one set of works between the chemical works and the weir, and those are the gasworks; the gasworks are recent, the chemical works are an old establishment.

11,945. Do the gasworks send any refuse into the river ?—The gas water or the gas tar, when sent into the river, is very injurious to our dyeing, but it does not so much fill the bed. Opposite my counting-house I can see the whole bed of the river covered with a sort of film, which, when the sun shines upon it, reflects all the different tints; that is exceedingly injurious to our dyeing.

11,946. How long is it since you saw such refuse as that in the river ?—I have seen it within the last two months. I have twice written a remonstrance to the manager of the gasworks upon the subject; he has always apologised and said that it was accidental and should not be repeated.

11,947. But that did not remedy the mischief which was done to your cloth ?—No. In fact we had to stop the pump from which we filled the large cistern over the dye house; that pump is from the river water, not from the water immediately opposite our works, but from a well sunk in what we call the Stannard, the ancient bed of the river, through which the water still filters its way.

11,948. Do you find that the water so filtered by this ancient bed is improved by that filtration ?—Yes, but it commences far above the gasworks. When we see the film which I have described to you coming down the river we immediately stop pumping so as to keep the water pure.

11,949. You know that there is no excuse for the gasworks pumping any of their water into the river, those materials being so valuable ?—Yes, that has always been alleged. The gaswork are under the local board, at Sowerby Bridge, and the manager has always asserted to me in correspondence that it was quite unnecessary and was a loss to them, and that he would take every pains in his power to prevent it.

11,950. What refuse do the chemical works pass into the river ?—The chemical works formerly passed a dreadful amount of refuse into the river; all their ashes used to be poured into the river.

11,951. Do they do so now ?—No, we have prevented them from doing it.

11,952. How did you prevent them ?—The nuisance became so extreme that we applied to the Court of Queen's Bench for an injunction to restrain them from throwing any solid matter into the river. A writ was taken out in January 1863, and an injunction was obtained in the month following.

11,953. Since then have they not cast any of that matter into the river ?—They have not cast in any solid matter to my knowledge; indeed they immediately adopted a new plan for their refuse; they got a long boat on purpose to take it away. That boat is filled three or four times a week, and sent down the canal to a place which they have taken of the Lancashire and Yorkshire Railway Company, under the viaduct which passes to Halifax.

11,954. What do they do with the refuse there ?—They got leave or rented ground belonging to the company under those arches, nearest the canal, and they unloaded the boat and poured the refuse down there. But the effect of that is injurious; that refuse is so corrosive that I have heard that it is actually destroying the stone and eating away the piers of the viaduct.

11,955. So that it is the removal of the mischief from your neighbourhood to the railway company ?—Yes.

11,956. The railway company will be pretty sure to look after that matter ?—I should think so.

11,957-8. What water power have you at your two mills of which you spoke as having been reduced by the filling up of the river ?—I do not know precisely the water power which we had, but you may conceive the difference by the reduction of the depth of the dam head from five feet down to two feet. Our tenant Mr. Fielding is in the room, and he perhaps may be able to furnish the exact water power.

(*Mr. Fielding.*) The two wheels are 30-horse power; one is 20-horse and the other 10-horse. I became the lessee of those two mills in 1854; at that time our mill dam, I was told, would would take three hours in drawing off; we can now draw it off in 20 minutes very easily. The bed of the river is so dammed up with refuse from the neighbourhood above that we have no reservoir at all, but just simply the bed of the river.

11,959. That affects the question of the river acting as a reservoir for your works, but it does not necessarily diminish your horse power ?—Yes, it does very much so, because we are dependent for our horse power upon the river being cleaned. So much refuse and sludge comes down the river that we are more frequently in back water than we can run.

11,960. The river below is filled up as well as the reservoirs above ?—I fancy that almost every manufacturer sends stuff into this river.

11,961. (*To Mr. Cronhelm.*) Have you observed that the banks of the Calder are more flooded than they were formerly, in consequence of this rising of the bed ?—I cannot speak precisely to that point. I should conceive it to be a natural consequence of the bed of the river being filled up that the floods would increase.

11,962. You have mentioned that you put your ashes upon the land adjoining the river and raise it by degrees, or you make land of it; do you find that that land is better or worse than the land upon which you do not put your refuse ?—We have not yet begun to grow any crop upon the elevated part of the holme. We put some soil on the top of the ashes; as we extend the heap of ashes we dig away the soil and put that soil on to them. I should therefore conceive that it would be of the same nature as the field below.

11,963. I believe that you have paid a good deal of attention to the streams in the parish of Halifax ?—I have.

11,964. And you have written upon the subject ?—I can scarcely be said to have written upon the subject. I once wrote for a bazaar a little tract on the rivers and streams of Halifax, supposing a pedestrian to enter the parish from the west end and to walk up the Calder, and then to walk up the other streams, it was merely a little sixpenny pamphlet.

11,965. In what year was that ?—I should think that it was about 10 years ago. I do not precisely recollect.

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11,966. Could you then give a more flattering description of the rivers as to their purity than you can now give?—I should think so. If you will allow me I will send to my bookseller and get a copy of that pamphlet which I will put in to the Commission.

11,967. Have you taken any steps to diminish the nuisance to the neighbourhood from the smoke emitted from chimnies?—We send out no smoke; we burn all our smoke by Jukes's furnace. It used to be a patent, but the patent has now expired and it is open.

11,968. Do you find it effective?—Very effective.

11,969. And simple in management?—Very simple; but it requires some little attention on the part of the stoker. Whatever improvements are made in furnaces much depends upon the stoker, the man who puts in the coal. The stokers have it in their power by throwing on too much coal at once to diminish the efficiency of the plan. The nature of the application of the coal in Jukes's furnace is this: there is a flat iron table at the mouth of the furnace, and there is a door which descends, which would close it entirely; that door is a little elevated so that the coal which goes in is perhaps at an elevation of 2 inches. Jukes's principle is that of a revolving grate; the revolving grate takes the coal at the mouth of the furnace, and spreads it over the whole.

11,970. Do you find that you economise fuel by using that process?—Undoubtedly.

11,971. Have you made any experiments to prove that?—Yes; there are calculations as to the amount of coal which would be used on the common furnace plan and on our plan. The least saving is, I think, one-fourth; it perhaps may come nearer one-third, but as to one-fourth I feel positive.

11,972. And that without producing any smoke?—Without producing any smoke.

19,973. Did you hear Mr. Child mention just now that he had been obliged to remove Jukes's furnace?—At his own works at Copley, but he uses Jukes's furnace at his great mill in Bowling Dyke.

19,974. Do you think that he uses it with as much success as you do?—I believe that it is satisfactory.

19,975. To what do you attribute the obligation to give up the apparatus in the case mentioned by Mr. Child?—Mr. Child himself mentioned that there was a great deal of trouble in keeping things properly in order. For instance, the bars in the case of the revolving grate, which are perhaps about 10 inches, if they are not kept in regular motion they are apt to consume very fast, and to become very expensive; but with care and attention to the regular motions of the revolving grate, which may be regulated by a crank from the engine, we can make it revolve either quicker or slower. Unless due care is taken in that respect, for instance, if the bars are allowed to remain standing a considerable time when charged with burning coal they may be destroyed prematurely, and thus become more costly.

11,976. But with ordinary care you find that the whole apparatus works very satisfactorily?—Yes. Our engineer has told me that the bars of the revolving grates will last five, six, or even seven years.

11,977. (*Chairman.*) What weight of ashes do you get from your coal?—About eight per cent. of the weight of the coal is turned into ash.

11,978. And that has to be got rid of?—Yes, that is carried to the holme to elevate its level.

11,979. As you have described?—Yes.

11,980. What refuse matter do you throw into the Calder?—Nothing but dye water.

11,981. That is the coloured water after it has been used for dyeing?—Yes. As to the means of obviating that, they would be very difficult indeed. There are only two plans of doing so, one of which would be too expensive. That would be for all the dyers on the different streams to unite and to construct a culvert to take the water to the sea, about 100 miles off. The cost would be about 100,000*l.*

11,982. That would be a remedy, but it would be worse than the disease, because you would be taking the water from the river, and all persons using that water would object to that process?—Yes, there would be of course a diminution of that water. I listened with very great interest to the examination of Mr. Ingham, by whose evidence it appears that the purification of dye water is very unavailing; that it may look as bright and pure as the water from a spring, and may yet contain the objectionable ingredients.

11,983. It may contain acids and other chemical ingredients?—Yes.

11,984. That is the case with regard to sewage when it has been once passed into water. We have no means of separating the chemical ingredients but by spreading it over land to facilitate vegetable growth. Merely passing it through a sand filter would not remove them, but by passing it over land where there is a productive growth of Italian rye grass, the natural action appears to seize the salts of the sewage, and to assimilate them, and then the water combines with the alumina and clay, and other ingredients in the earth, and goes away comparatively pure water. So that by agricultural means you can really purify sewage until it becomes as wholesome as pure water. Taking Croydon, the sewage is day by day passed on to areas of land, and on one side you can see it passing in, dark and full of excrementitious matter, and on the other side of that land going off as bright as spring water, and a chemist can detect very little difference between it and the water of the river into which it flows, and which is soft drinking water, and trout have come there. But it is not every place that you can get land so favourably situated or of sufficient quantity?—It is a very interesting subject.

11,985. Is there anything which you wish to add to your evidence?—I believe that I have answered all the questions which are on my sheet. Had there been any others I would have given answers to them.

The witness withdrew.

Mr. J. Fielding.

Mr. James Fielding (Sowerby Bridge) examined.

11,986. (*Chairman.*) Where are your works situated?—At Mereclough Mills, Sowerby Bridge.

11,987. Upon what stream?—The Calder.

11,988. What number of hands do you employ?—Perhaps 50.

11,989. What business do you carry on?—I am a dyewood grinder and dealer. I occupy the mills spoken to by Mr. Cronhelm. I have two water mills on the Noreland and the Skircoat side of the Calder. I also live on the banks of the Calder.

11,990. Do you use water power for your purposes?—Yes.

11,991. And steam power as well?—Yes, we have about 30-horse steam-engines with water power.

11,992. What weight of coal do you burn?—That is uncertain, because we use the steam-engines as supplementary to the water power.

11,993. Is the water power sufficient when there is water in the river?—It has been sufficient, especially in the last six months, when we have had a great deal of water. We burn all the wood which we extract (we also extract dye woods); perhaps we consume six tons a week, burning them under Jukes's furnace, it is therefore almost impossible to say what coal we consume per annum.

11,994. What form of refuse is produced in your manufacture?—Ashes and wood, generally chip and rasp wood.

11,995. About what weight of that wood do you think you have per annum?—About 300tons per annum.

11,996. What do you do with it?—We consume it all under the furnace.

11,997. With the ashes?—Yes.

11,998. You have refuse ashes from the coal?—Yes, and we have a very small soot in the flues of the boilers which we clean out every month; we have to convey the soot upon our land, we mix it with our manure.

11,999. Do you pass any of your solid refuse into the stream?—Nothing whatever.

12,000. Do you use water for any purposes connected with your business?—Yes, in making our dyewoods.

12,001. Where does that water generally come from?—From the river.

12,002. Have you any water from the Halifax corporation?—None whatever at present.

12,003. Where do you get your water for boiler purposes?—From the river.

12,004. Do you condense?—Yes, we have a condensing steam-engine.

12,005. And you condense with the water of the river?—Yes, and then turn the water back again.

12,006. Are you near the canal which the last witness spoke of?—Yes, very near it.

12,007. Do you use the canal water at all?—On that side of the canal there is the Skircoat Mill where we use water power exclusively, and therefore we have no communication with our steam-engines.

12,008. How long do you remember the river and the canal?—I have lived there since 1854.

12,009. In what condition are the river and the canal as compared with what they were when you first knew them?—I was aware that the river was continually filling up with the rubbish put in by people above, and therefore I engaged with others to form an association to prevent people putting ashes and rubbish into the river Calder. We kept the association on for about two years, but it fell through because we had not strength to resist, not only the local board of health but the gasworks, and all the people above; they poured everything into the stream and thereby diminished our water power.

12,010. Do they continue to do so now?—They do so partially now. I have seen the local board of health wheel the road scrapings right into the river. I have known them allow rubbish of all sorts to be put into this river; it is well known that our local boards of health are generally interested in filling up this great sewer, in fact the river Calder has now become now the great common sewer of the district.

12,011. In what state is the canal?—The Calder and Hebble Navigation is generally a black stream because there are many dyeworks upon it. The last witness told you that he poured his dye water into the canal, and so do the persons next to him; it goes in as black as ink, the water is generally very filthy.

12,012. Is it offensive in dry weather?—I have been told so; I live on the banks of the Calder, and we are very much annoyed with what is continually coming down this river. In fact so late as last Sunday there must have been something from the gasworks, because every room in my house was filled with a most horrible stench, and very frequently the men working in my mill have been obliged to come out for fresh air, they have been almost suffocated with the stench from the gas water.

12,013. If there had been a river conservancy to whom you could have appealed, I presume that you would have set them in motion very rapidly against these offenders?—I should be very glad if it could be done, because nothing else but that can compel manufacturers to keep out their refuse, nothing else than the strong arm of the law. We tried it for two or three years, but we broke down for want of strength. We won one trial, and lost a second, and could not carry the matter on any longer, and broke down; in fact no man likes to injure his neighbour; a man dares not come forward and sign an affidavit that his neighbour does this, that, and the other, because it is so difficult to compel him to desist. People have promised that they will desist, but they do not, and in my opinion nothing but the strong arm of the law will suffice.

12,014. As the law now stands, in order to interfere with these proceedings, it requires that one neighbour should indict and prosecute another?—It does.

12,015. Do you think it advisable that some new regulations should be established by which an independent body should take charge of these proceedings and so prevent that unneighbourly act?—I am quite sure that that is the only mode which can be adopted to prevent this river having all sorts of pollution thrown into it, that has been my opinion for years.

12,016. Then you think that persons who pour their solid refuse into a river should be prevented from doing so?—Yes.

12,017. And you think that pouring gas refuse into the river should be prevented?—Yes.

12,018. And if any persons in your trade sent in solid refuse you would say that the law should prevent them from doing so?—Yes.

12,019. You find that you can and do carry on your trade without sending in any solid refuse?—Yes; even as regards our privies we have generally ashpits, and the soil goes on to the land.

12,020. You have been impeded in your operations by the filling up of the bed of the river?—Very much so indeed.

12,021. Supposing that you wished to restore your mills to their original power, have you any idea what it would cost you to carry down the bed of the river to its original level?—All the hollows or pot holes are choked up so that we are compelled to clean them out; we do that every summer. Some of the contents we take where we can and some we let pass down to our next neighbour.

12,022. Then you would come under the lash of the law, if the law were put in force so far as regards that?—Certainly. We should be very glad to join in any scheme which could be adopted for carrying that refuse down to the sea.

12,023. Or for keeping it out of the river altogether?—Yes. The dyers, so far as I have heard, all say that they cannot keep out their dirty water, but I think that they ought to be compelled to do so as far as possible.

12,024. (*Mr. Harrison.*) As an extractor of dyewood, could you suggest any means by which refuse might be kept out?—I was surprised to hear the evidence of Mr. John Ingham, of Bradford, where he said that 600 tons of chips entered the river. Why not burn them?—We burn all our logwood chips and all our fustic chips, and all our American bark which we extract.

12,025. They all admitted that they could burn the chips, but the difficulty was with the rasped wood?—I think that they ought to be taken away and burned. No doubt that rasped wood after they have got the colour out of it is very injurious to the river, because it will fill up and make a large bed.

12,026. (*Chairman.*) I suppose that a filter would strain out the solids of the rasped wood?—It would. Some people set fire to it, putting it upon a heap and burning it. It is not at all impossible to keep it out of the river, they might as well burn it as not. I apprehend that many gentlemen will say that they do burn it.

12,027. (*Mr. Harrison.*) Can you state what weight of dyewoods is used for the purpose of dyeing?—No. This is a large district for its consumption. I myself grind from 60 to 100 tons a week, and that is all consumed in the neighbourhood; that is chip and rasped woods.

12,028. If you valued the injury done to your two mills by the filling up of the river, what should you put it at?—We should have to deepen the river. I conceive that the last day or two has shown the people the folly of putting in so much rubbish, because thereby the river is made so much shallower, and when a flood comes it destroys all your property.

12,029. Do you know from your own experience that that has been the effect of the filling up of the bed of the river?—Yes. Yesterday I was up in the valley of Todmorden. I came down by the railway there, and I was astonished to see such havoc. The turnpike road and the river and the canal were all level with the water; they were impassable for miles, and I have no doubt the damage will be very serious indeed.

12,030. Do you know Todmorden?—Yes. They are in the habit there of building their privies over the river, and all the refuse comes down this river, and the river has been choked up there many times. They

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deserve all they get, because they have sinned with their eyes open; they have kept building, and throwing in, and throwing in, and they have told us as an association in 1864 that they had done so and would do so.

12,031. Then you cannot help looking upon the devastation with a little satisfaction?—The last witness and myself waited upon them, and we waited upon all the millowners, and tried to persuade them not to do so, but to think of their neighbours, and of those people who suffered below, but they said that it was a right which they had, and a right which they would maintain, and therefore we gave our attempt up; our association fell to the ground.

The witness withdrew.

Mr. T. Hastings.

Mr. Thomas Hastings (Stainland) examined.

12,032. (*Chairman.*) What business do you carry on?—I am a paper maker and cloth miller.

12,033. Where are your works situated?—In Stainland.

12,034. Upon what stream?—Upon the Blackburn, and a small stream running through Stainland, the name of which I do not know. I have always called it the Stainland Beck.

12,035. Are they two separate works?—Yes.

12,036. Are they both of the same character?—No, one is for paper and the other is for milling cloth.

12,037. In the paper works what number of hands do you employ?—From 40 to 50.

12,038. What tonnage of paper do you make per annum?—About 200 tons a year here. We have large works in Leeds where we make a great deal more.

12,039. Do you know what volume of water you use for that purpose?—I should think that we use about 7,000 gallons a day, that is for the paper mills.

12,040. Out of what do you make your paper?—Linen and hemp.

12,041. Is it a fine quality of paper?—No, it is paper for pressing cloth.

12,042. Do you use any Esparto grass?—Very little.

12,043. Do you make your pulp upon your own premises?—Yes.

12,044. You do not purchase pulp from any other place?—No.

12,045. What becomes of your waste refuse in washing and cleansing?—It goes down the river.

12,046. Have you privies or ashpits?—Privies.

12,047. Where does the refuse from the privies go?—On to land.

12,048. You do not pass it into the stream?—No.

12,049. Are there any works situated above you?—Yes.

12,050. What are they?—There are both worsted and cotton and woollen works.

12,051. Do they dye?—Yes.

12,052. And do they taint the water as it comes down to you?—Yes.

12,053. Do any of them pass in ashes or other solid refuse?—Not to any great extent. I have known it done, but I do not think that it is done so as to be objectionable. If they wanted to get rid of an extra cartload of stuff which was in the way it might find its way into the stream, but I do not think that it is regularly done.

12,054. Do you use water power?—Yes.

12,055. Is it at all impeded by the casting in of solids?—No, I cannot say that it is; it probably costs me a few pounds extra in cleaning out my dam.

12,056. Below your mill-tail has the bed of the river at all been filled up with refuse?—It was a few years ago, but I took the tail goit a little lower down, and I have not had any inconvenience since.

12,057. What weight of lime do you use in bleaching?—Perhaps about 5 tons a year.

12,058. And what quantity of sulphuric acid?—I cannot say. We do not bleach much, but we use lime for boiling.

12,059. Do you filter the water at all?—No, we used formerly to run it on to a piece of holme land which we had.

12,060. After it left you?—Yes.

12,061. That was for irrigation?—Yes.

12,062. With what effect did you do so?—It produced a luxurious crop, but the grass was coarse. The difficulty with refuse from a paper mill is that a very considerable quantity of the fine fibre of the rag goes away with the water, and if it is not very carefully watched it has a tendency to destroy vegetation rather than encourage it.

12,063. Have you heard of a recent filtering process by a Mr. Needham, for taking out that refuse from the water?—No, I have not seen or heard of anything of the kind.

12,064. There is a patent press at work by which you could recover every atom of that material; you could recover the finest possible fibre in the shape of pulp, and at a cost which would pay you handsomely?—It would still have the dirt along with it.

12,065. That press is for the pulp which comes from the machine?—My mill here is a hand mill, and we do not allow much of that material to go. I know that there are savealls for that purpose, which can be used, but we do not allow much material to go. It would not much affect my water; it is worked over again. When you are washing rags, before you can get them clean a certain amount of fibre always goes with the dirt, and if you got it you would only have the dirt over again and it would be of no use to you.

12,066. But if it was of no commercial use yet you could extract it?—I have not seen any machine which would do it, on account of the great quantity of water which it must go through.

12,067. This same machine is used by the potters in Staffordshire and other places to extract their clay; they pump the water with the clay in solution into one of these machines, and they can solidify the clay at a cost of about 2*s.* 6*d.* a ton. There can be nothing in your refuse which would be half so difficult to separate as a solution of clay. Do you know what is the proportion of water which is required in your manufacture?—I do not; it depends very much upon the kind of paper and the extent of washing. Some kinds of paper, the coarser kinds, require a very small quantity of water; but if you require to bleach the material, or to wash it thoroughly for bleaching purposes, you must have double or treble the quantity of water.

12,068. Do you know the large paper works which belonged to Mr. Crompton?—I do not know the works, but I know the name.

12,069. The proportion usually taken is 1,000 lbs. of water to 1 lb. of paper?—Yes. I may be wrong in the quantity of water which I have given as that which we use because I was not prepared for these questions.

12,070. Have you made yourself acquainted with what Parliament has done with respect to paper making on the Thames?—No. I have seen that there is an injunction against McMurray of Rickmansworth on a tributary of the Thames.

12,071. Is that very recent?—Yes.

12,072. Have you seen the Thames Conservancy Act passed in the last session?—I heard of it.

12,073. There is an Act of Parliament in which definite restrictions are to be put upon paper making on the river Thames?—I will get it.

12,074. What is the other manufacture which you carry on?—Fulling cloth.

12,075. Where is that manufactory situated?—The two establishments are near together.

12,076. How many hands do you employ there?—Only a few.

12,077. Have you any refuse of any sort?—Yes, there is a good deal of dirty water from the scouring of the cloth.

12,078. Does that pass down the stream?—Yes. I made two filters in a coarse way, to see whether I could not pass the water through clear to the stream, but they very soon got choked. Then I

mixed a small quantity of lime with the water as it ran away from the machine, and I found that it deposited much quicker with the lime than without it; but still I found a very great difficulty in making the water at all pure, besides it created a great nuisance on the premises. I have plenty of room, but a foot path goes past my works, and I was afraid of being indicted for a nuisance.

12,079. So that you pass that refuse away now as you did before?—I do. I partly run it on land, but we cannot run it on land all the year round.

12,080. Why not?—Because we cannot do it during the hay season.

12,081. If you tried a small portion of land with Italian rye grass you would find that you could grow Italian rye grass all the year round; you could irrigate all the year round, and you could cut grass all the year round, excepting when the surface was covered with frost and snow, and then you might put the refuse upon the surface; if it froze it would be all right; if it saturated the snow it would be all right, and when a thaw came it would not be a nuisance. At Croydon they always irrigate?—I presume that they cut their grass and use it green.

12,082. They do, and it is most beneficial when used for milch cows; it produces the largest amount of milk and the best butter. Have you any further observation to make?—I have this to say. The stream above me, the one coming down from Stainland has become very foul indeed, and the smell is quite a nuisance. I complained to the manufacturers above me, and they agreed to send the dirty water past me. This has not been carried out, but I have no doubt that it will be, unless there is some regulation about passing dirty water into the Calder. My impression of the way to get rid of this difficulty is the same as Mr. Cronhelm's, namely, that you must send a dirty stream and a clean one side by side, and I think that the quantity of dirty water which would require to be passed down a dirty stream is not nearly so great as the general impression represents it to be. It is only for two or three months in summer that the stream would feel the withdrawal, and I presume that there is more water coming down from these compensation reservoirs in the Halifax district than ever came down the Hebble in a dry time before those reservoirs were made.

12,082*a*. Then you think that the true solution would be to make intercepting drains, and to take the water away?—I do.

The witness withdrew.

Mr. John Crossley (Halifax) examined. *Mr. J. Crossley.*

12,083. (*Chairman.*) In what business are you engaged?—I am a dyer.

12,084. Where are your works situated?—At Bailey Hall upon the Hebble.

12,085. What number of hands do you employ?—From 150 to 200.

12,086. What weight of material do you use in the shape of solids?—Of dyewoods, such as logwood, fustic, and peachwood, we use about 200 to 300 tons in a year.

12,087. What weight of sulphuric acid and lime and other bleaching material do you use?—We use about 5 tons of soda ash, 10 tons of soda, 20 tons of ammonia, and about 30 tons of acids in a year.

12,088. Have you steam power?—Yes.

12,089. What horse power have you?—Our steam-engine is called 12-horse power.

12,090. What weight of coal do you use per annum?—We use nearly 20 tons of coal per day.

12,091. Do you know the weight of the ashes?—We generally take away about 3 tons of ashes per day.

12,092. What do you do with them?—We lead them to the railway station principally.

12,093. You do not pass any into the stream?—None at all.

12,094. What volume of water do you use per day?—We pump from the wells about 150,000 gallons, we have two wells on our premises.

12,095. To what depth are they sunk?—The one is 10 yards and the other 20.

12,096. Do they vary at any time of the year?—They do not vary very much.

12,097. What is the quality of the water?—It is hard.

12,098. Then is it injurious for your purposes?—No; it does very well indeed for dyeing and cleansing purposes, but we use a little of the corporation water for scouring, it saves soap.

12,099. How much of the corporation water do you use?—About 8,000 gallons a day.

12,100. At what price?—I forget now; I think that it is about 8*d*. at present.

12,101. What weight of soap and oil per annum do you use?—Perhaps about 4 tons of oil per annum, and about the same quantity of soap.

12,102. Do you attempt to extract any of it from your waste water, after you have performed your washing operation?—We do not extract either oil or soap.

12,103. Then it passes away with your refuse water?—Yes.

12,104. Do you extract the solid parts of the dyewoods, after those dyewoods have been used?—No, except that there are some articles, such as sumach and divi-divi, and that sort of article, which are used in cotton for the warp, and which we take and mix with the night-soil. Of the chip wood we do not use 1 cwt. in 12 months, and any chip wood which we do use we burn.

12,105. Have you waterclosets or privies?—Privies.

12,106. What becomes of the refuse?—We take it on to land and mix it with vegetable refuse.

12,107. You do not let it go into the stream?—No.

12,108. (*Mr. Harrison.*) What weight of wool do you use?—We do not dye wool as wool, but we dye piece goods. We dye perhaps 4,000 or 5,000 pieces a week when we are busy; at present we are not dyeing so many as that. They vary from 5 lbs. to 20 lbs. each. The average weight, I should think, would be about 10 lbs. Some of these goods are mixed cotton warps and wefts, and the others are all wool.

12,109. (*Chairman.*) Are there many works similar to yours situated above you?—Yes, a great many.

12,110. In what condition is the water of the Hebble as it comes down to you?—It is very bad.

12,111. Is it worse than it was when you first knew it?—When I first knew it it was as clear as spring water.

12,112. Would it be a benefit to you if it could be rendered clearer than it is now?—Without doubt.

12,113. Should you then be able to use it for your washing purposes?—If it was clear we could use it for both dyeing and washing.

12,114. Can you use it now for either of those purposes?—We occasionally can use it for dark colours. Yesterday we were obliged to stand. We generally use it for condensing purposes, and for steam power, but so many ashes and things of that kind come down that they very frequently stop the pump.

12,115. Then some persons do throw ashes in above you?—There is no doubt that ashes do get in somewhere above me.

12,116. And you find them out in your pump?—Yes.

12,117. Do you think that it would be proper to prevent persons who use the streams from pouring in ashes?—I think so. We used to have a society which professed to look after the matter, and to fine every one who put ashes in, but I do not think that much has been done lately in that respect, at the same time the stream is better now than it was before the Ogden reservoir was formed.

12,118. I suppose that many of the large manufacturers do keep their ashes out of the stream?—I believe that they do their best to keep the stream as clear as possible.

12,119. And perhaps to a greater extent than they did 10 years ago?—Certainly. Since I remember you

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could go up and see ashes on both sides of the river, and as soon as a fresh came they were taken away; we did so ourselves in Wheatley. The roads in Wheatley at that time were positively full with ashes. The surveyor used to come to our works and say "I want a small quantity of ashes," and we put them there, but if heavy rains came they were washed down the roads and we knew that they must go down the stream.

12,120. (*Mr. Harrison.*) Did you hear what Colonel Akroyd said yesterday about purifying the dyewater?—No.

12,121. He said that he had tried experiments, and that the addition of lime would throw down the colouring matter which was in suspension, and the water would pass off in a comparatively pure state, and that that machinery only occupied a small space?—It would be possible, I think, to do it at small works, but not at such works as ours and Kirks.

12,122. If it could be shown that it could be done in a small space, would it be a benefit to you, and to all dyers, to carry it out?—I think not; some years ago we tried to precipitate iron and other matters in the water with lime, and the action was so irregular that it was very difficult to get the colour which we wanted; sometimes when we wanted a purple we got a red. Although the water is clear to the eye, yet it contains acids, and alkalies, which are a great detriment to us when we come to use it.

12,123. Any system of that sort would not assist you for dyeing purposes?—Not so far as I see.

12,124. Would it be useful for cleansing purposes?—It might for cleansing some things, though if one portion of the water contained acid and another alkali it would vary the shades of colour.

The witness withdrew.

W. H. Rawson, Esq., J.P.

WILLIAM HENRY RAWSON, Esq., J.P. (Halifax), examined.

12,125. (*Chairman.*) In what business are you engaged?—We are manufacturers and merchants.

12,126. Manufacturers of what?—Woollen cloths.

12,127. Where are your works situated?—At Mill House on the Ryburn Brook; we have other works in Ovenden.

12,128. What number of men do you employ?—Perhaps 700 or 800 men and women taking the two works together, but I cannot recollect the number exactly.

12,129. Do you use water largely?—We use a good deal of water.

12,130. Where do you obtain it from?—We have large springs of our own from the hill side, the water from which is collected in reservoirs of our own, and we also have the Ryburn Brook.

12,131. Then you use the brook water?—Yes.

12,132. Do you use steam or water power?—Both steam and water power.

12,133. What horse power and what water power have you?—To the best of my recollection we have about 60-horse steam power, but it varies a good deal, being in conjunction with the water power; I am not able to give a definite answer to that question, because my object is merely to give evidence upon the smoke nuisance; I came unprepared with other details. The amount of our water power depends upon the amount of water in the river at the time.

12,134. Have you found your water power at all impeded or interfered with by solid refuse coming down the stream from above you?—Not particularly, except that Mr. Morris, our neighbour above, annoyed us a little with solid refuse, but I think that he has remedied that now.

12,135. What extent of engine power do you use?—About 60-horse power altogether.

12,136. What weight of coal do you burn per annum?—About 3,000 tons, if I recollect rightly; we burn about 45 tons a week at Mill-house works.

12,137. What becomes of your ashes?—We generally use them or they go upon the roads; we never turn a single ash into the river except there happens to be a heavy flood and then a few go over; we have a great extent of roads, and the surveyors take the ashes away to repair the roads.

12,138. You do not systematically tip ashes into the stream?—Never.

12,139. Do you think that any manufacturers in Yorkshire do so?—I am afraid that they do; but I do not wish to speak evil of my neighbours.

12,140. Do you believe in the possibility of smoke prevention?—There is no doubt of it.

12,141. Have you had experience in preventing it?—We have prevented it for the last 10 or 11 years.

12,142. Do other manufacturers prevent it?—I am sorry to say that they do not generally, but they are beginning to do so to some extent.

12,143. If they are left to their own devices do you think that so good a practice will be followed?—It is difficult to say.

12,144. Would you make it compulsory that they should prevent smoke?—I should.

12,145. What means have you taken to prevent smoke?—We have Jukes's furnaces exclusively.

12,146. How long have you had them?—We began to work with them 11 years ago, and for several years we have had nothing else.

12,147. Do you know what was the cost of applying that process to your boilers?—We made a good many improvements of our own, and I should think that the whole cost to us has probably been about 120*l.* a boiler. I should say that it could be done cheaper now. I think that it could be done for about 100*l.* a boiler over and above the cost of an ordinary furnace, and adopting every improvement.

12,148. Of what size would those boilers be?—About 30-horse power.

12,149. Would they be 6 feet in diameter?—I think that ours are 7 feet in diameter.

12,150. Of what length are they?—28 feet.

12,151. What does the patent consist of?—Jukes's patent has expired.

12,152. What does the arrangement consist of?—We have ourselves made a great many improvements.

12,153. Can you describe briefly what the arrangement is?—It consists of revolving grate bars, and the coals are carried gradually forward. The fire is fed by a hopper. The coals are fed about every 40 minutes by the fireman upon this hopper, and are gradually moved forwards on the fire, so that no smoke is made. The coal is ignited the instant that it approaches the fire; it is ignited by a brick arch above.

12,154. The material is roasted out of the coal, and turned into a flame immediately?—Yes; no smoke is made.

12,155. Can you maintain your steam power as efficiently by that process as by the ordinary mode of firing?—Undoubtedly.

12,156. If any person told you that it was impossible to carry on his trade without making smoke what should you say?—I should simply say, "I am sorry that you are so ignorant." We have done it ourselves for 11 years, and I think that I can speak with some practical knowledge upon the subject.

12,157. When you began it did you believe that you could do it?—No, nobody was more bigoted than I was in the first instance, 10 or 11 years ago; I did not believe that it could be done.

12,158. You were determined to try?—Yes, for these reasons: that I have very extensive gardens and conservatories round me, and I was so thoroughly beaten by the smoke nuisance upon my own premises that I was determined to carry out this process for my own benefit.

12,159. Then your interest lay in the consumption or prevention of your own smoke, and your intelligence forced you on?—I saw that it could be done, common sense showed me that it really could be done.

12,160. Your belief lay in that direction?—Undoubtedly; I believed that it could be done, but I was at first afraid that it would be done at a very great expense. I was afraid that expense would be a stumbling block.

12,161. Do you find the apparatus all injurious to your boilers?—Not in the slightest degree.

12,162. Do you find it more expensive than if you fired in the ordinary way?—It is a great deal less expensive.

12,163. Does it save you in weight of coal?—In our own case it saves at least 20 per cent. of coal, and there I think that I am under the mark. I think that I might venture to say 25 per cent., but I will say 20 per cent.

12,164. Then if 100,000 tons of coal are carelessly consumed in Halifax, producing this intense amount of black smoke, 20,000 tons might be saved and no smoke made?—Undoubtedly; I will give you the results of it in our own experience at Mill House. We formerly always had five large boilers in work, and since we have adopted Jukes's patent, we have done away with one of those boilers, and have sold it; before we always had four boilers in operation and one standing, since the application of Jukes's patent we have never had more than four boilers, namely, three in operation and one standing, and I should think that we have been making 20 per cent. more steam with those three boilers than we did with the four before.

12,165. We will cease to talk about Jukes's patent because patents frighten people and we will call it Jukes's apparatus as modified by your arrangement. You have no hesitation in saying that where coals have to be used, and power has to be obtained, you may consume the coals and produce the power without generating dense smoke?—Undoubtedly; I am only speaking of our own case, we make no smoke.

12,166. The law must sweep away what people say is impossible in that respect?—I am afraid that that is what the law will have to do; certain remarks were stated at the Bradford Town Council to have emanated from yourself. It was said there by some one or other that you had stated publicly that the burning of smoke entirely depended upon the stoker; that there was no system which had come out, and that you didnot know of any system which would come out, which would effectually burn smoke without the result depending upon the stoker; and that you would undertake to work any mill in Bradford without any dense smoke. That you might do, but I could not allow these remarks of yours to go unchallenged before the public, because it is more than likely that many persons would be very glad to shelter themselves, and would say, "There is Mr. "Rawlinson, the Government Commissioner, who says "so and so." I wrote to the "Leeds Mercury," and I quoted these remarks, and I said, "Will Mr. Rawlinson "himself admit that he actually stated such facts?" It is very desirable that the public should know whether that is so or not, and I cannot allow those statements to remain unchallenged.

12,167. I will admit it in this way, that with regard to Jukes's patent we have had evidence that persons have tried it and have pronounced it to be a failure, and have abolished it because they have said that it did not serve the purpose which was intended. I said that patents might be put in use, and might be so managed as not to accomplish the purpose, but that in every case (and I say it advisedly now) it might be done by careful firing. I believe that your boilers might be worked as economically and with as little smoke by careful firing as by your arrangement. I know establishments which have been carried on for years, simply by an arrangement with the fireman that he should not generate smoke, but should be paid extra for not producing smoke, and he has accomplished the purpose. There is no witchcraft in the arrangement, for Jukes's patent is simply putting the coal near the front of the fire near to the door, near to the dead plate, and drawing it evenly and continuously towards the bridge, and always firing upon the front?—Just so.

12,168. If I owned steam boilers my workmen should all do the same by hand?—If you will excuse my saying so, if the matter is to be entirely dependent upon the stoker himself, it will never be done, but in Jukes's system you have a self-acting apparatus which does it independently of the stoker, and it cannot go wrong.

12,169. (*Mr. Harrison.*) In Jukes's process you get rid of the opening of the door?—Yes, the front of your boiler is in a measure hermetically sealed, and the stoker seldom has to look at his fires from morning to night. In the last trial which we made, he never touched his fires for 48 hours, during which time we made an experiment as to the amount of water evaporated.

12,170. (*Chairman.*) An arrangement was put into operation when I was a boy; there was then a revolving disc like a great coffee mill in front of the boiler, the small coal was scattered in front and there was a self regulating arrangement acting from morning to night. As soon as the steam had risen to a certain height, a strap was thrown off a fixed pulley on to a loose pulley and the matter regulated itself. What has become of that process I do not know?—In Jukes's patent no air is admitted in front, and no door has to be opened, there is no cold air to throw down the steam, the fire gets no air excepting underneath and through the bars.

12,171. If there is to be a government regulation with regard to the prevention of smoke, do you not think that it would be more advisable simply to say that smoke shall be prevented, and to say nothing about the means?—Decidedly.

12,172. Because there may be other means?—Certainly; I only speak from our own experience. I say that it can be done, and is done, and ought to be done; I should say, let people take their own course.

12,173. They will then have no excuse?—Just so; in the first place you will have no smoke, you will also make a saving of at least 20 per cent. in fuel, and where you have a large number of boilers I believe that you will make an enormous saving in stokers' wages. If you have 20 boilers half the number of men under Jukes's system will work those boilers, as compared with the Cornish system of boilers, and it will be with one-fourth of the labour to themselves.

12,174. I am extremely glad to hear this evidence from you, and I at once accept it as proving a fact which has been put to the test of experience and has been corroborated by others, and which therefore shows that those persons who have put in operation, as they say, Jukes's patent, and have paid their money, and then have abandoned the process, have either allowed their firemen to deceive them, or have been so careless that they have paid no attention to them?—That is the case.

12,175. I think that if you have seen the tenor of my remarks you will perceive that this is what I said?—Those remarks were made three or four months ago, some of the members of the council stated what you had said, and I said, "Whether or not Mr. Rawlinson "stated so, it is desirable that the public should know "whether he did state it or not."

12,176. I state now what I have stated before, that smoke consuming is in some respect a matter of faith. I never yet knew any establishment where steam power was used where smoke consuming could be established if the head of the firm did not believe in it. Only show me an individual and let him tell me, "It is of "no use your talking to me, I have tried to consume "smoke, and I do not believe in it, and know that it "cannot be done," and I am quite aware that it will not be done in that firm; but I go to another establishment (and this I have learned above 20 years since) the head of that firm acquaints himself with the conditions necessary to smoke burning; he establishes his own faith from conviction, and he says, "I know that "it can be done, and it shall be done," and then it is done?—It was done by me in the same way, but in many cases failure arises from the stupidity and ignorance of the stoker. I was determined, 11 years ago, to be the master. We had a very stupid old engineer who had been with us 20 years; a very clever intelligent man was at the other end, and the stupid fellow said, "What "do you know about this? I have known about this "before you were born;" and he threw every obstacle in the way. I went to him and said, "I am to be the "master and not you, and on this day fortnight you "leave, and the stoker under you." I was sorry to be compelled to do it. That is 11 years ago, and that man is with me now, and his stoker also, and he would give his head rather than go back to the old system.

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12,177. That quite agrees with what I have said. I have said that when there is the intelligence to insist upon good and careful firing, you may fire an ordinary boiler and not generate anything more than what is called parliamentary smoke, but you must pay for it, insist upon it, and have it done?—You would require double the number of boilers to do it. In Jukes's system there is the advantage that you have a continuous furnace all day long, always generating steam; but if you do it as you propose, you must double the number of boilers and fire very lightly.

12,178. That I refute?—I am afraid from my own experience that you will find it so. I have not a doubt about it.

12,179. The law is not always clear; some Acts of Parliament have said in their clauses that persons shall provide themselves with apparatus capable of preventing smoke. The law makers thought that by that arrangement smoke was to be prevented. What has been the effect? Persons have been summoned for a smoking chimney, and they have pointed to this clause in the Act of Parliament, and have brought forward their witnesses to prove that they have had the apparatus, but that the stoker was careless, and the magistrates did not convict?—But I think that the law will have to say by and bye that you shall do it.

12,180. And to let the fine be cumulative?—Yes; it is the interest of the parties to prevent smoke on account of the enormous saving to them.

12,181. (*Mr. Harrison.*) What weight of coal do you use per annum?—At this mill 45 tons a week has been our average, and I will engage to say that it would take in many places 90 tons to do the work which we do.

12,182. That is 2,340 tons per annum?—Yes.

12,183. What do you give for that coal per ton?—I suppose that it is now about 8*s.* 6*d.* a ton, but the price has been advancing so much that it is almost impossible to say.

12,184. That would be about 1,000*l.* a year, and that is divided among four boilers?—Four boilers, but only three always in work.

12,185. That would be 333*l.* a year for each boiler?—Yes.

12,186. And you say that you save a quarter of the coal; therefore, you save one-fourth of this amount?—Yes.

12,187. That would be upwards of 80*l.* a year which you save?—Yes, as compared with what we formerly burnt before we applied this process.

12,188. That is 80*l.* per annum saving upon each boiler, whereas the apparatus you say only costs 100*l.* to put up?—It would, I suppose, be about 100*l.* now in excess of the ordinary furnace.

12,189. Therefore, the saving in about a year and a quarter would pay for the expense of putting up the apparatus?—Undoubtedly, and in our own case we have no trouble whatever; this goes on from year to year; we have no outlay for damage. I can show Mr. Rawlinson a boiler which has been going on for about four years, and has not had a penny expended upon it.

12,190. (*Chairman.*) But if you had not been gifted with a little faith, and a good deal of obstinacy, you would have been beaten?—Yes, but I was not to be beaten, and I think that I have been the means of introducing a good number of these furnaces into this district since. There is another point to which I should like to call your attention, and that has reference to the ashes which are made. I happened to read the evidence of many of the Bradford manufacturers the other day, and I see that by their statements they make nearly 1/4th of ashes. By Jukes's process in our boilers we scarcely make 1/20th of ashes. I may say that we do not make more than 1½ cwt. of ashes for a ton of coal by using Jukes's process. That shows you at once the enormous saving in the coal; the coal gets so thoroughly burnt that nothing is left. In the last trial which we made, about 6 tons of coal made I think 6 cwt. of ashes.

12,191. Have you tried anything with your domestic fires to economise coal and to save smoke?—Nothing whatever, as coal is so cheap in our part of the world.

12,192. Let me tell you how you may save half your coal, and produce no smoke, and have a far better fire?—I can easily believe it. I do not think that any plan will ever answer which is merely dependent upon the intelligence of the stoker. It must be self-acting so that he cannot go wrong. I am now speaking of boilers.

12,193. Is there anything further which you wish to add?—No; but I shall be delighted if I can show you these boilers worked as they ought to be worked.

(*Mr. Fielding.*) I also have two of Jukes's furnaces, and I have just replenished with new grate bars one boiler which has been at work 12 years. I should wish to say that once replenishing will make them last for that time.

12,194. (*Mr. Harrison.*) Do you produce a saving of coal?—Yes.

12,195. (*Chairman.*) Have you had the same arrangement with your firemen?—Yes.

(*Mr. Rawson.*) There was a great objection to this external firing. You asked me whether we had had any injury with the boilers. We have only one boiler on our premises which we consider a bad boiler. We always get the best Low Moor boilers, which we consider the cheapest in the end. We have one boiler which we contracted for 10 or 12 years ago—a Lancashire boiler—which we considered a bad boiler, and we had a good many repairs to make to it. That condemned boiler has been going 10 years with Jukes's apparatus, and is as good now as it was then. Unfortunately, in the present day, the workpeople set their faces against anything which will do the work more quickly.

The witness withdrew.

Mr. D. Clay.

Mr. Daniel Clay (Sowerby Bridge) examined.

12,196. (*Chairman.*) You are a woollen manufacturer?—Yes.

12,197. Where are your works situated?—At Sowerby Bridge on the banks of the river Calder.

12,198. What number of men do you employ?—About 300 hands men, women, and children.

12,199. What weight of coal do you consume?—About 50 tons per week.

12,200. What weight of ash do you make?—We have never made that calculation, and I cannot tell you that.

12,201. What do you do with your ashes?—We take them over the river, and lay them up until they are wanted to be taken up for mending roads.

12,202. Do you throw any of them into the river?—No.

12,203. Have you any smoke-preventing apparatus?—No.

12,204. Have you heard the evidence which Mr. Rawson has given?—Yes.

12,205. Do you believe it?—I cannot doubt his word, but other persons experience difficulty; for instance, Mr. Ackroyd and Messrs. Crossley. I have heard a good deal about it, and I think that the difficulties may be overcome if there is a determination in the matter.

12,206. You will have to stand up to your fireman and make him acquiesce?—Yes. I believe that it can be done with an intelligent fireman.

12,207. Do you use much water?—A good deal.

12,208. Where do you get it from?—From some springs which we have in the yard, and others on the hill side. We have been so troubled with the river water, having had so many goods spoilt with it, that we were obliged to be at an expense of nearly 1,000*l.* to get pure water. We have this pure water for something like six months in the year, but during the remainder of the time we are obliged to take the river water, which is very bad in summer time. It is generally dirtier in summer than in winter.

12,209. How long have your works been situated where they are?—100 years.

12,210. You used the river water on your premises at the first?—Yes, at one time we did so.

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12,211. And it has gradually been growing so much worse that now you cannot use it?—We cannot use it.

12,212. It has spoiled your goods?—Yes, to a great extent.

12,213. And it has done you serious damage?—Yes. We make white goods, and we have been sadly plagued with tar on the pieces.

12,214. Has the state of the water prevented you making those white goods?—No, because we have got another supply of clean water, but it has done us a great injury.

12,215. Is your water hard or soft?—Soft.

12,216. Do you dye at all?—Yes, a little.

12,217. What materials do you use in dyeing?—The same as other dyers—indigo, and logwood, and other dyes.

12,218. Do you know what amount of solid refuse you make?—No, it is not a large amount.

12,219. Does it pass into the river?—Yes.

12,220. You have not attempted to intercept it?—We have not.

12,221. Do you use much soap?—We use a pretty fair quantity of soap, but I cannot state how much.

12,222. Do you intercept the soapsuds, and get any of the soap back?—We sell them to Messrs. Teall, Le Paige, and Company, of Wakefield.

12,223. How much do they pay you?—About 150*l.* a year.

12,224. Do you know what weight or value of soap you use?—No.

12,225. But it must be a large quantity?—Yes.

12,226. Do you know what weight of wool you use?—I daresay that we use about 100 packs of wool every week. We are worsted spinners as well.

12,227. What accommodation have you for your workpeople? Have you privies or waterclosets?—Privies.

12,228. Where does the refuse go?—We have carts made for the purpose, and we cart it away on to land.

12,229. You do not put it into the river?—No.

12,230. Are there any works situated upon the river below you?—Yes.

12,231. A great many?—Yes.

12,232. You receive the pollution which comes down from above?—Yes.

12,233. And it annoys you in the river?—Yes. It has more particularly done so latterly. Our next neighbours above have just built a dye-house above us, and since they have built that dye-house the river water has been a great deal worse, in summer time particularly.

12,234. How far is their dye-house above you?—About a mile.

12,235. Then it would be a costly thing for them to send their dye water past your premises in a sewer or outfall?—They may pass it down in that way, but I do not know whether it would do for their purpose.

12,236. Do you use any of the dirty water for your steam purposes?—We use it for condensing purposes for the steam-engine.

12,237. Do you feed your boilers with it?—Yes.

12,238. We have had it in evidence that that dirty dye water is better in some instances for feeding the boiler than a bright spring water?—Our river is not so bad as it is at Halifax, it is cleaner.

12,239. What is generally the character of the refuse which comes from your works. You say that you dispose of the ashes and that you dispose of the soil from the people, and that the soap refuse is disposed of?—There is nothing but the dye-house water which is sent into the river.

12,240. Do you think that it would be difficult to retain the solids in the dye-house refuse before the cold water goes into the river?—I think that it would not be so very difficult. I have known it done. Our predecessors, I believe, did it. The refuse is run into a tank for the purpose of having it as manure for the land.

12,241. Then you would not be very much punished if you were told that you must not let the solids go in?—I think not, looking at what we make.

12,242. (*Mr. Harrison.*) Do you think that anything could be done in the way of purifying the dye water itself?—I do not see that it could. I could not say, after hearing the evidence, that it could be done.

12,243. What weight of solid dyewoods do you use in the course of a year?—We do not use very much dyewood. We use a good deal of indigo. We use very little of the wood.

12,244. Is the refuse diluted with water which is impregnated with indigo?—No; we do not turn the dye water into the tank. It is only from the cloth mill.

12,245. Do you think that you could precipitate the indigo from the dye water by any means?—No, I do not see how it could be separated.

12,246. If any simple means could be recommended for separating the colouring matter from the dye refuse water at a slight expense, without taking up much room, should you object to it?—No, I should very much like it to be done.

12,247. If all persons were obliged to do it do you think that you, as a dyer, would be benefited?—Yes, decidedly.

12,248. So that, although it might be an expense to you, you might get an advantage?—Yes; we should be compensated by having clean water.

The witness withdrew.

Mr. Richard Bracken (Luddenden) examined.

Mr. R. Bracken.

12,249. (*Mr. Harrison.*) You are a paper manufacturer, I believe, on the Luddenden Valley?—Yes.

12,250. Have you works near the junction of that brook with the Calder?—At a distance of about a mile and three-quarters.

12,251. Are there any manufactories situated above you?—There are some spinning mills above us.

12,252. But no dyeworks?—No.

12,253. Or any manufactories of any kind which pollute the water?—No.

12,254. Then you get the water to your works in a tolerably clear state?—Yes. Latterly we have had the water a little muddy in consequence of the carrying out of the waterworks.

12,255. That is only a temporary inconvenience?—Yes.

12,256. Do you use the water of the Luddenden Brook for paper making?—Yes; a good portion of our water comes from the brook, and we have some spring water which we economise and use when the other is dirty.

12,257. What character of paper do you make?—Brown paper. We make a little half-white paper. We do not make any white paper. We call it a brown mill.

12,258. Do you use any quantity of bleaching materials?—A little.

12,259. What is the refuse which you throw into the brook?—We do not throw in any refuse, except the dirty water which we have used for washing.

12,260. Do you add any alkali?—We use lime to boil with.

12,261. You boil the rags with lime and wash them?—Yes.

12,262. And all that wash water passes down into the brook?—It does.

12,263. Containing dirty lime water and some of the materials, I suppose, of the rags?—The fine portion of the fibre which is washed away.

12,264. What do you do with the solid lime?—The solid lime which does not go into the rags we take on to the land.

12,265. What other materials in the shape of chemicals do you use besides lime?—We use a little bleach and sulphuric acid.

12,266. Do you pass the bleach into the water after you have used it?—We do not wash out the bleach. We use chloride.

12,267. And of course it would be to your disadvantage if you let the chloride of lime pass away

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before you had got all the goodness out of it?—I do not know whether it would be economy or otherwise, but it is convenient to do so.

12,268. Do you use water power?—Yes, and steam.

12,269. What amount of power in each case?—I should think about 50-horse steam power and 40-horse water power. The water varies.

12,270. And you use steam to make up the deficiency?—Yes.

12,271. What weight of paper do you manufacture in the course of a year?—Between 600 and 700 tons.

12,272. Do you know what volume of water you use for cleansing that paper?—I have no idea.

12,273. What weight of coal do you use. That again depends upon the water supply?—Yes, about 1,700 tons.

12,274. Do you use any means for consuming the smoke?—None beyond careful firing.

12,275. Is that effectual?—Not very much so.

12,276. I think that after the lesson which you were taught by Mr. Rawson just now you will probably be looking about to establish some system of smoke prevention?—I am afraid that I have not Mr. Rawson's determination.

12,277. Do you use any Esparto grass?—No.

12,278. You use rags of rough quality, I presume; not white rags?—Just so.

12,279. What weight of lime do you use?—We use about 100 tons of lime in a year.

12,280. And how much bleaching material?—The quantity is very small. The bleach, I think, would not be more than three or four tons, and the sulphuric acid about the same.

12,281. What do you do with the ashes which you make?—We have had a good deal of trouble in disposing of them. We have buried them lately.

12,282. You do not turn them into the brook?—We have not done so for very many years. We did not throw a shovelful in yesterday, although we were very much tempted to do so.

12,283. Does the Luddenden Valley extend for some distance above you?—Yes.

12,284. Has it a considerable fall?—Considerable.

12,285. The quality of the water, I suppose, is much the same as that of the Hebble?—I should say so.

12,286. Is it open to any manufacturer in that valley to obtain a site, and to commence dyeing and other works?—Yes, I should say that it is.

12,287. Should a dyer locate himself above you and pollute the water how would it affect you?—It would affect me injuriously.

12,288. It would oblige you to find another source of water supply, or, I presume, to leave your premises?—The water is frequently fouled, and we have provided for ourselves a tolerable supply of water for washing purposes. We have constructed two reservoirs, one of about 19,000 feet and the other of about 12,000 feet.

12,289. So that you are comparatively independent?—Yes.

12,290. But you might be injuriously affected?—We might be injuriously affected.

The witness withdrew.

Mr. W. Morris.

Mr. William Morris (Sowerby Bridge) examined.

12,291. (*Mr. Harrison.*) I believe you are a manufacturer at Sowerby Bridge?—No; at a place a mile and a quarter from Sowerby Bridge, called Triangle.

12,292. You are also one of the Vice-Presidents of the Chamber of Commerce for the Halifax district?—Yes.

12,293. Are your works situated within the parish of Halifax?—Yes; immediately above those of Mr. Rawson, who has given evidence.

12,294. Not within the borough, but within the area supplied by the corporation with water?—No; it is beyond that.

12,295. What trade do you carry on?—Worsted spinning.

12,296. How many hands do you employ?—About 400.

12,297. Do you use water power or steam power?—Both water and steam power combined.

12,298. Is the water obtained from the corporation?—No; from the Ryburn, which is a tributary of the Calder.

12,299. What horse power or what steam power do you use?—Combined, about 50-horse; the water power is variable.

12,300. When you have a good supply of water, what is it?—The maximum is about 14-horse; the average power does not exceed 8-horse. We always use steam power.

12,301. Are there other mills above you on that stream?—Yes, several.

12,302. Do you find any inconvenience from their passing solid matters into the river so as to affect your water power?—I do, but only occasionally. I experienced a loss some few years ago, in consequence of the flood bringing down a great deal of débris against the shuttles, which, when drawn, went into the goit. As I attempted to turn, as usual, without being aware of the obstruction, the main gearing broke down, and I was put to a cost of 50*l*.

12,303. Had you no remedy against anyone above you?—That I do not say; it was a friend and neighbour.

12,304. Do you think it is desirable to have all solid matter kept out?—Most undoubtedly.

12,305. What weight of coal do you use?—About 1200 tons per annum.

12,306. Do you carry out any system of smoke consuming?—No, no more than giving instructions to the fireman to do all that he can, and by the admission of air to supply as much oxygen as he can without cooling the furnaces.

12,307. Did you hear Mr. Rawson's evidence?—No, but it is a question that has so often been discussed between us that I am quite aware of all that he could say.

12,308. Is it the fact that his chimney is free from smoke at Mill House?—I should think it is.

12,309. As far as smoke consumption goes, his system appears to be perfectly successful?—Yes.

12,310. Do you agree that if he can effect a saving of from 20 to 25 per cent. on the coal, it is desirable to carry out the same system?—Yes; but that is only a partial view of the question. I have never heard it confirmed by anyone that the saving of coal is anything equal to that. I live next to Mr. Rawson, and I am as anxious as he is for the suppression of smoke. My daily comfort is involved in it, and I am always inquiring upon the subject, and I can succinctly state the result of my inquiries.

12,311. Will you be kind enough to do so?—It will be necessarily very short. The prevention of smoke is highly desirable. It can be accomplished in a great degree in ordinary furnaces by the provision of more boiler room than is absolutely required for the economical raising of steam, if that extra boiler room is combined with judicious firing; or it can be accomplished by mechanical means, say by Jukes's patent, but only at a greater cost of repairs and stoppages. But even this system, to be worked advantageously, necessitates more boiler space to prevent combustion being forced. Under these conditions, I believe a diminished consumption of coal would be the result; and although all legislative restrictions upon trade are liable to result in evil, and ought to be avoided as much as possible, yet I think the public comfort may demand the compulsory limitation of smoke. The law, to be just, however, must be of universal application where practicable.

12,312. Did you hear Mr. Rawson say that he should be able to do away with one boiler altogether in consequence of adopting Jukes's system?—It is pain-

ful to give evidence in opposition to Mr. Rawson, because I know it is a darling subject with him; but I feel the great importance of this inquiry, upon which legislation may be based, and therefore all neighbourly feeling must sink, for if you go away from here with opinions expressed in an important town like Halifax, and legislation is based on those opinions, if they are erroneous, we should do a great wrong to you and the public. Messrs. Whitworth, of this town, who are enterprising and bold men, sparing no expense, but always with a view to frugal management, have put down, I believe, four boilers with Jukes's furnaces, and I have asked Mr. Whitworth three or four times, and he stated in answer to my last inquiry this week, that more boiler room is required for Jukes's furnaces, for they cannot otherwise get up the steam. The great evil of Jukes's furnaces is this; there is no doubt that they prevent smoke, but the boilers are liable to be burned away, and also the furnaces, even with the protection that one of Mr. Rawson's men has patented, are liable to be injured, and frequent stoppages may occur as the result. A gentleman, who shall be nameless, lately put a boiler up under circumstances to give it every opportunity of being worked out without regard to expense. Still he gives it as his opinion, that where there was only one boiler, it would be dangerous for them to rely on Jukes's invention; the stoppages being so frequent, and the flame so intense at the mouth of the furnace, there is a calcareous deposit on the boiler to which it is always liable, and they are liable to be burned out. I should say that stoppages are multiplied greatly from the use of Jukes's furnace as compared with ordinary boilers. Still I think if you could place all the country under one universal law, so that one manufacturer should have no great advantage over another, all might be obliged to provide sufficient boiler room. Jukes's invention would then be found to be very useful, accompanied with a saving of coal; but you must have a larger firing space; for instance, to refer to the Chairman's opinion as expressed during the inquiry at Bradford, he stated that he would undertake to fire without causing any smoke, and that the usual plan was to choke up the front of the fire; but the proper plan ought to be to push forward the incandescent coal, and to place the fresh live coal in front. The consequence of that would be, that you would cover a large part of the furnace, through which the air would not pass sufficiently for perfect combustion, and the upper surface would become caked by the action of the fire. You would then find it impossible to raise the amount of steam that the works would require.

12,313. (*Chairman.*) You are attempting to describe the effect of the mode of dealing with the fire which I recommended?—I am.

12,314. Then I can confidently state that it is as erroneous a description as could possibly be given. If a thing has once been done, do you believe it can be repeated?—Under similar circumstances I believe it could. I have anticipated that by saying that with a larger than ordinary surface of furnace it could be done, but if you want to increase your steam you could not do so. There is a tendency in all of us to go on increasing our business and to put on as much power as the engines or boilers can do, and if you start with an abundant supply of boiler room you will find yourself in a few years with a larger weight of work on the engine, in which case steam can only be raised by making the boilers do all they can. I still dissent from the opinion that you can raise the same amount of steam with firing as you propose in comparison with the plan I am speaking of.

12,315. It has been said that the State should not interfere with trades because trade will do what is necessary, and therefore it would not be a proper thing to say to manufacturers, Carry on your business as you like, but you shall not throw out dense volumes of smoke?—I think that it is quite competent for them to do so without governmental interference.

12,316. You would let the manufacturers do it in whatever manner they please?—Yes.

12,317. The State should not dictate the mode, but simply say, We believe that your trade can be carried on without black smoke, whether with more boiler space or with less we do not say, or whether with a saving of fuel or otherwise. Carry on your trade in the best manner that you can but you shall not pollute the atmosphere of the district with black smoke?—I think the public may claim that at the hands of the Legislature.

12,318. The rivers are filled with abomination in the way of sullage and fluid. Is it not the duty of the Government therefore to say, It has been proved to us that the manufactures of the country can be carried on without pouring into rivers solids, such as ashes and effete matter of human excrements, solid refuse from dyeing processes, such as spent woods, either chipped or rasped, and other solids. You as riparian owners for the future use any other means you like, but you shall not make the rivers of the country your scavengers?—In a manufacturing district the first purpose of streams is to aid manufacturing industry, and they may reasonably receive all liquid or soluble refuse from works connected therewith, for it is not often that it is injurious to health. Solid matter ought, however, rarely to be thrown in. Streams may also serve, in the absence of other provision, for the drainage of excremental and other refuse, if liquid or soluble, from dwelling houses, but when from the numbers of the population the healthfulness of the atmosphere is injured, then it ought to be compulsory to have subsiding reservoirs or tanks combined with a system of deodorizing, and, if practicable, from local conditions, of utilizing the sewage.

12,319. If you can prohibit the discharge of effete refuse from a town surely you can do so in the case of one individual or one house. You say that certain solids may go in, but cannot you see your way to the prohibition of solids of all kinds?—Yes, very nearly. Without being too doctrinal and positive I think that all solids might be prohibited, but the reason why I draw a distinction between a unit and numbers is this, that where you have a number you can go to the expense of collecting and diverting the sewage, which you could not do in individual cases. In Triangle there is no other mode for any refuse, liquid or soluble, passing away from that village except by its natural drainage down to the river.

12,320. If you beg the question so far as that the legislature might as well put down its hands and say nothing could be done?—How am I begging the question?

12,321. You say that the village is in such a position as that the effete matter from it cannot be prevented from going into the river. There is an invention which has been recently introduced called the dry earth closet, and by that pollution of the river might be prevented. At Wakefield they are putting the invention to the severest test; they are using these earth closets in the cells of the prison. Therefore it might be said to the owners of property in your village, or to the residents there, you shall not pass your effete sewage matter into the river, you may use earth closets, it will be a much cleaner and sweeter system for you, and you will have the advantage of retaining the refuse. If you have a garden you may use it there; if not, it can be taken away and deposited elsewhere so as not to be offensive?—That system might do for small cottages, but I cannot conceive it possible that in the ordinary dwellings of this country such a process could be conducted daily and weekly.

12,322. You can conceive that if a dwelling house has its drain connected with the nearest watercourse or river, and there are persons below inconvenienced by that drain, you would have a right to say to the person occupying that dwelling, You shall not inflict any inconvenience upon the persons below you, and at whatever cost or labour to yourselves you shall resort to some other method, either a common privy or an earth closet?—A common privy would be a remedy worse than the disease; miasma would always arise from it.

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12,323. But by the use of an earth closet the difficulty could be got over with a little additional manual labour?—My waterclosets drain down into my dam, and therefore I do no harm, but still I coincide with you to this extent, I say that towns with a large population might be subjected to compulsory regulations, such regulations to be put in force by inspectors appointed by corporations or boards of healths, but with a power for a given number of inhabitants, say 12, in case of any neglect on the part of an inspector, to enforce the application of the laws by appeal to a county or governmental authority. We are not at issue on these main points, and I agree with you generally. It is not only excrementitious matter but all the nasty filthy stuff which cottages have that ought to be kept out of the river. You are aware that by the Common Turnpike Road Acts, at every 20 yards or some other given space, there must be openings made for drainage from a common high road, showing that the law contemplates there must be some passage to that main arterial drainage. The whole thing is bound up in one great system; you cannot ask a cottager to have a large reservoir in which to collect the water, his refuse must follow the natural course of drainage. I think it is highly desirable that where the atmosphere is likely to be polluted, some great system should be adopted. Above us at Ripponden if they are building a cottage they cart on to the bridge the soil they remove from the foundations and they pour it into the river, and so it comes into my dam.

12,324. Do you not think that that should be prevented?—Undoubtedly.

12,325. Supposing that you took proceedings against them now what would be the result?—There would be very great difficulty in getting evidence as to the fact, and much expense also.

12,326. Have you formed any opinion, if any legislative enactment is to be passed, what form the conservancy of the river areas of the country should take?—No, not beyond what I have previously expressed.

12,327. (*Mr. Harrison.*) Did you read over the evidence that was given by Mr. Ripley at Bradford?—Yes.

12,328. You are a Vice-President of the Chamber of Commerce in this district?—Yes.

12,329. Did you observe the figures which he gave as to the weight of wool manufactured in this neighbourhood?—Yes, I did; I know also the parties who assisted in preparing those figures, and I have the fullest confidence in their intelligence and integrity.

12,330. Do you believe that we can depend upon them as being as accurate returns as any that can be made?—Yes.

The witness withdrew.

T. Shaw, Esq.

THOMAS SHAW, Esq., (Halifax) examined.

12,331. (*Chairman.*) You are Mayor of the borough?—Yes.

12,332. What business do you carry on?—The worsted and woollen trade.

12,333. Where is your mill situated?—In Stainland on a branch of the Calder.

12,334. What number of hands do you employ?—About 2,000.

12,335. What weight of wool do you deal with per annum?—We use about 350 packs per week.

12,336. What volume of water do you use?—About 600,000 gallons a day for condensing, dyeing, and cleansing goods and wool washing; about 200,000 gallons for condensing, 50,000 gallons for dyeing purposes, which become very dirty, and about 250,000 gallons for cleansing the goods after being dyed, but that does not become very dirty, and 100,000 gallons for wool washing with soap.

12,337. What weight of soap do you use per annum?—About 700 packs a year.

12,338. About what quantity of oil?—I cannot state.

12,339. Do you use any chemical ingredients, such as acids?—Yes, for dyeing.

12,340. Do you use sulphuric acid?—Yes, we use about 140 tons of acid liquor per year.

12,341. For dyeing purposes?—Yes.

12,342. Do you use any lime?—Very little.

12,343. Any dyewoods?—Yes, but not many, generally rasped logwoods.

12,344. What weight of them do you use?—In dye wares altogether we use about 200 tons per annum, of indigo about 50 chests.

12,345. What weight of coal do you use in a year?—About 6,000 tons.

12,346. Do you know what amount of ashes they produce?—About 10 per cent.

12,347. Are you a smoke maker or a smoke preventer?—Our engineer professes to be a smoke preventer; we do consume it.

12,348. Do you use Jukes's patent?—Yes.

12,349. Like Mr. Rawson?—Yes.

12,350. Can you state how long you have used this means of preventing smoke?—We have not got Jukes's patent throughout the establishment; our man has a patent, or professes to have, but he does prevent the smoke by some arrangement of his own.

12,351. Does it save fuel in your case?—I cannot say that it does, but it prevents the smoke, and that is what is required.

12,352. What do you do with the ashes?—We have many bye roads that we have to repair, and we put the ashes on them.

12,353. Do any of the ashes go into the river?—None.

12,354. Do you use any water from the river?—Yes.

12,355. For what purpose?—For general purposes. We get water from wells and springs, on our own premises, as well as from the brook.

12,356. Do you get any from the corporation waterworks?—No.

12,357. Do you know what quantity you obtain from the wells?—About 100,000 gallons a day; we have a bore-hole of about 600 feet deep.

12,358. How near does the water rise to the surface?—Within perhaps five yards.

12,359. Does it vary during the year?—No, we do not find that it varies.

12,360. Do you throw any waste refuse matter into any brook or stream?—We throw in what rasped wood we use.

12,361. That goes in with the waste dye water?—Yes.

12,362. Do you do anything with the soapsuds?—No; we did so, but we have been building over where we had a convenience for that purpose, and we are making further convenience to extract the grease.

12,363. At the present time the grease goes into the river?—Yes.

12,364. The rasped wood goes into the river?—Yes; the chipped wood we burn.

12,365. (*Mr. Harrison.*) Could not the rasped wood be prevented from going into the river?—Perhaps it might.

12,366. What privy accommodation have you on your premises?—They are all privies; we have them in coaches, and we take the sewage on to the land after they are filled.

12,367. You do not pollute the river with it?—No.

12,368. Is the stream worse now than it was when you first knew it?—Yes.

12,369. Are there any mills above you?—Yes.

12,370. Do any of them send their ashes down the stream?—No.

12,371. Have you any water power?—No, we had, but it is done away with.

12,372. Is the bed of the stream rising opposite to your works?—No, I do not suppose that it is; it is only a small rivulet.

12,373. Were you at all inconvenienced by the flood of last night?—No.

12,374. Is there any agricultural land close to your fields?—Yes.

12,375. Would it be convenient to put the dye refuse on to any portion of that surface to irrigate it?—I do not know; we might do it, but I do not see that it would be any benefit to the land.

12,376. Why did you abandon the water power?—Because we did not find it advantageous, it was only a small power, abount 16 or 18 horse, and we lost work by it; we found that in using steam power we could produce far more weight of goods than what would compensate for the amount of coal.

12,377. Therefore you did not abandon the water power because there was any obstruction in the river, but because it was uncertain?—Yes, we could not get the weight of material out by its use.

12,378. Does the river now contain as large a volume of water in dry weather as it used to do when you first knew it?—I do not suppose that it does.

12,379. How has it been reduced in volume?—I think the land drainage runs the water out quicker.

12,380. Are there any reservoirs at the head of your stream?—Only our own.

12,381. Have you a reservoir?—Yes, two.

12,382. What area do they cover?—I cannot say.

12,383. Where does the mud go to when you cleanse them?—Down the river.

12,384. If any regulations were laid down as to the purification of the river, and a clause prohibited mud to be flushed into the river, you would have to find some other mode of getting rid of it?—Yes.

12,385. Do you see any other mode of doing it?—The mud comes from the bottom, and perhaps we should abstain from flushing it out if others did the same.

12,386. Proprietors of mills above you do the same as you do; they flush their mud out and you suffer from it?—Yes.

12,387. Do you ever shut down your shuttles to prevent it coming in?—Yes.

12,388. Then the people below you, if there are any, would have to put their shuttles down when you sent your mud out?—Certainly.

12,389. Do you use Jukes's boilers?—Yes, one.

12,390. How long have you had it?—Some two or three years.

12,391. Does it answer?—I cannot say that it does; we have it in one of our separate mills; we have only one boiler connected with it, and we frequently have stoppages for a week in making repairs, in altering and repairing parts, more particularly the plates of the boiler, for if you are not very particular with the water that is supplied to the boiler, and any sediment gets to the bottom of the boiler, the powerful heat that Jukes's invention sends out burns out a plate, and then a new plate is required.

12,392. You are not quite so warm in favour of this invention as Mr. Rawson was?—No, not at all; the only question is this, supposing that instead of one boiler there were six, they might answer, because there would be plenty of boiler room, but I do not agree with him in saying that they can do with fewer boilers.

12,393. Have you much difficulty with your boiler from the effect of the water?—I do not suppose there is much.

12,394. Some of the water that is used in this neighbourhood we have heard causes no deposit, is it possible that Jukes's patent might be unsuccessful in one case where incrustation was liable to take place, but might be successful in another where the water produced no incrustation?—Certainly, but it is very difficult to get the kind of water which causes no incrustation.

12,395. (*Chairman.*) Some of the water from the dyeworks that has got grease and acids in it proves to be the best for boiler purposes, because it never forms any incrustation?—Yes, but the misfortune of Jukes's patent is that the fire is underneath the boiler; if you have the fire-boxes near to the boilers you do away with any sediment.

12,396. Jukes's patent makes it necessary to have cylindrical boilers with the furnace underneath?—Yes.

12,397. The process is not applied to an internal furnace?—No, they cannot apply it, I believe.

12,398. Have any of your boilers internal furnaces?—Yes.

12,399. Are they Galloway's, with tubes passing through the flues?—Yes, conical tubes.

12,400. There are two furnaces in one boiler, and by firing the two alternately you prevent smoke?—Yes; we have the door perforated as well, and when they are fired the fireman shuts the perforated door, and lets a little atmospheric air in; it passes in during the first flush.

12,401. And in that way smoke is prevented?—Yes.

12,402. (*Mr. Harrison.*) Are you satisfied in the first place that smoke can be prevented?—Yes.

12,403. Are you also satisfied that it can be prevented without the manufacturer sustaining any decided loss?—Of course it depends upon capital, because supposing that a man could only afford to put down one boiler with a steam-engine, I should not advise the application of Jukes's patent to that; if there were two boilers it would be all right.

12,404. (*Chairman.*) Can you use steam power and not produce a dense volume of smoke?—Yes.

12,405. Either with one boiler, or with any number of boilers?—Yes.

12,406. Do you think it would be injurious to any class of trade if the legislature made it imperative that all boilers should be so used as not to produce smoke?—No, I do not suppose it would; as far as I can judge it would not.

12,407. Leaving the means of doing it to the individuals, but saying, smoke shall not be sent up your chimneys?—I think it can be done.

12,408. Do you think it possible for a person earning 100*l.* a year, by carelessly working his chimney to destroy property worth many thousands a year by throwing out dense volumes of foul smoke into the atmosphere?—Supposing that a man puts boilers down and pours out a dense volume of smoke from his chimney, and goes on uncontrolled, he may injure other people's goods to an extent far greater than I can pretend to say.

12,409. Supposing it could be proved that he could carry on his business without making that smoke, should you think that he ought to be compelled to do so?—I should say so.

12,410. You think that the law ought to say, you shall not do it?—Yes.

12,411. (*Mr. Harrison.*) With regard to dye water, you heard, I believe, what Colonel Akroyd said yesterday about filtering; have you ever tried any experiment of that kind?—No.

12,412. If he is correct in his views, do you think there would be any hardship in enforcing such a system as he spoke of, I mean a system of using lime as a precipitate in a compact filter?—If it could be done we should be glad to do it.

The witness withdrew.

WILLIAM ALEXANDER, Esq., M.D., M.R.C.P., (Halifax), examined.

W. Alexander, Esq., M.D., M.R.C.P.

12,413. (*Chairman.*) I believe you have certain information which you wish to lay before the Commission?—Yes.

12,414. Have you formed any opinion as to the physical character of this district?—I have. I am the author of a paper on the geology of the parish of Halifax, and that necessarily involved its physical character.

12,415. What is the character of its geology?—As a mountainous region it is variously elevated from 400

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feet to 900 feet above the level of the sea; the inclination of the plane varying from 1 to 4 inches in a yard, its general drainage is towards the Calder, and its declivity with an inclination to the west and south, from the summit of the moorland. The stratification of the district is that of the millstone grit, and this town, standing upon the middle member of that series, the upper soil is of a light peaty character, a non-retentive soil, which will hold but 25 pounds of water per so many cubic feet, whilst at Leeds and Sheffield the same area of soil would hold 60 pounds of water.

12,416. Would you not infer from that that you would have a dryer atmosphere here?—Usually so; nevertheless it varies a good deal; the mean annual temperature is 48·5, with a rainfall of 240 days amounting to about 34 inches; the aqueous vapour averages one per cent., or about three grains of water in a cubic foot of atmosphere.

12,417. How long have you known this district?—I have known it all my life as a native, and for 25 years as physician to the public hospital.

12,418. Have you made any estimate showing the progressive increase of population?—I have but little to add to what has already been stated by the town clerk and the ex-mayor, but I may observe that this town doubles its population in about 28 years; the parish takes 44 years in accomplishing the same purpose.

12,419. Have you collected any statistics as to the local mortality, or can you state anything as to the character of the local diseases?—I have had upwards of 70,000 of the labouring poor under my charge, and therefore I have had ample opportunity for observing these particular points. I quite concur with the ex-mayor in much that he has stated. I could perhaps a little better than he describe the haunts of disease and the localities in which it is most frequent, and describe something of the districts bordering upon the lower levels, and the outfalls of the drainage as to which perhaps this Commission would wish for some information. The Public Health Act was granted upon my petition.

12,420. Are there certain parts of the town where the mortality is much larger than in others?—Very much so; the greater the density of the population *cæteris paribus* the greater the amount of sickness and mortality.

12,421. Is that necessarily so?—I think it is necessarily so; the fouler the atmosphere the lower the standard of health of the population.

12,422. In what localities in Halifax should you say there was the greatest amount of disease?—The Old Bank is one, and others which I trace on the map; Charlestown is an unhealthy district.

12,423. What are the types of disease which prevail in those districts?—These districts are chiefly occupied by the humbler and more destitute class of the population, and as such there is no doubt that their habits and want of cleanliness, and the want of suitable and properly cooked provisions expose them to disease; there are a variety of causes that will greatly modify the influence of such diseases and their results, and I estimate that for one death there will be usually about 10 attacks of illness.

12,424. Do they suffer from typhus fever and typhoid fever?—Not generally. I may observe that with regard to typhus we have not above five per cent. of the gross mortality who die of that disease. The deaths from consumption are one in eight of the population, whilst old age carries off one in ten.

12,425. Is there occasionally typhus and typhoid fever among the poor?—Yes,; but less so than formerly in Halifax.

12,426. Do you know of your own knowledge the condition of the patients in Wakefield gaol?—Not very well, although I know the officials there, the resident surgeons.

12,427. If typhus fever can be banished from the gaol at Wakefield, is it practicable in your opinion to banish typhus fever from the cottages of the poor?—I have always thought it highly probable.

12,428. If you could give the poor more space for air and persuade them to have better ventilation, improve their moral habits, and make them more careful as to clothing and living, do you think they might get rid of typhus fever?—Yes; epidemics would, by such means, be very materially modified, and rendered more harmless; when they did appear they would present a less grave type.

12,429. Is typhus fever a disease very fatal to adults?—Yes; I think it is more so than to children.

12,430. Is it not more fatal to adults between the ages of 20 and 40?—Yes, it is not confined to them at all, but it is more fatal. It is not however our scourge, for pulmonary consumption and affections of the respiratory organs are the prevailing diseases here.

12,431. What do you think generates those diseases?—Partly the climate; it is partly constitutional taint in the case of consumption.

12,432. And perhaps the nature of the occupation?—Yes, frequently.

12,433. From living in confined rooms?—Yes, and dusty departments; a fatal trade here is that of the stonemasons and quarry men.

12,434. In consequence of inhaling stone dust?—From inhaling stone dust and gritty particles which fly off from their chisels.

12,435. I believe they are not a very sober race?—No, the quarry men are not; the stonemasons are more temperate.

12,436. Have you made any chemical analysis of the water in the Hebble Brook?—Yes, from time to time, when I had leisure to devote to the sanitary question upon which I gave some courses of lectures some years ago, I then made three or four chemical analyses of the water of the Hebble Brook.

12,437. Have you any of the analyses here?—No.

12,438. Do you remember them?—Yes; there are some in Mr. Ranger's report. I can tell you that the foreign bodies found in the water consist of sulphuretted hydrogen, sulphates, soda, pearl-ash, ammonia, traces of green copperas, a great deal of organic matter, and in summer time infusoria and insect life, such as are found in stagnant pools. In times of flush of course the quality of the water differs, and then you would require to take three or four samples, the chief part of which would still be impure.

12,439. Do you find that infusoria will generate in water although containing a certain amount of chemical matter?—Yes, they can be detected by the microscope.

12,440. There is a considerable amount of lime and sulphuric acid, the products of dyeworks, and other ingredients passed into the stream, and yet you say that the infusoria generate and live in this water?—Yes; they are found there.

12,441. The ova are generated there?—Yes, and then if you consider that this occurs in a stream constantly flowing there, there must be a large dilution. If 30 tons a day of minerals are thrown in from the dyeworks, there would be a large dilution before those acids reach the place from which I took the specimen.

12,442. Is there anything further that you wish to add to your evidence?—I know all the tributaries of the Calder, and every foot of ground as a native of the place; I knew them as a boy, and from traversing every one of the 20 townships which constitute our parish in the course of business, I have got to know almost every part of the district; and I may say that the health of the people generally along those tributaries is often undermined. A residence along a watercourse in my opinion is undesirable in almost any case, but it must be still more undesirable when those streams are filled with organic matter and excrementitious deposits; and although the exhalation does not actually kill the inhabitants on the confines of the streams, yet their health is undermined; they live, but they are not in vigorous and robust health, and they become easy victims when seized with a malignant disease, such as

epidemics among infants; and erysipelatous infections and blood diseases, especially the adult population.

12,443. (*Chairman.*) If the wealth of a country is embodied in the health and strength of the inhabitants of that country, any legislation which tends to preserve health, and to prolong life, would cæteris paribus add to the wealth of the country?—Yes; it is a great relief to the rates and to the families whose heads would otherwise be called prematurely to their final rest.

12,444. Then if we legislated for purely selfish purposes, we should do the best possible thing by improving the health of the country, setting aside other and higher motives?—Unquestionably.

12,445. As selfish men we should be doing the best possible thing if we did all that was possible to improve the health of the working classes and to preserve that health to the longest period?—Decidedly so.

12,446. You find that more settled strength represents wealth, and that if you turn the country into barrenness by pollutions, such as are going on, property will revert to its original condition, when without inhabitants it had no value?—Yes.

12,447. (*Mr. Harrison.*) I take it for granted that you look with satisfaction upon the corporation waterworks, supplying the requisite quantity of water to the mills which are growing upon the hills of Halifax rather than in the valleys?—I do.

12,448. Enabling the population to be more scattered, and the labouring classes to reside in a more healthful position?—Yes.

12,449. Have you had any opportunity of analysing the Hebble water since Mr. Ranger's report, which is of some years standing?—That was, I think, in 1851. I have occasionally tested the Hebble water with litmus and turmeric paper, but I have not gone through a chemical analysis.

12,450. Would the analysis in Mr. Ranger's report in 1848 represent the present Hebble water?—Yes, with the condition that the water will differ according to the freshets and the floods. I recommended that beck to be tunnelled 20 years ago as the best thing which could be done, seeing that it was to be our main sewer. I recommended the tunnelling of it from Lee Bridge to Salter Hebble. It would then have been out of sight, and I thought that the reclaimed land would have paid the expense of the work. The stench along the banks of the Hebble from Salter Hebble to Clark bridge in a north wind is horrible.

12,451. The mayor and the town clerk have informed us that there are 960 waterclosets, but that there are a great number of ashpits and privies in the borough of Halifax. From your experience would you at all attribute the ill health of the poor to those ashpits, as well as to the cramped condition of the buildings?—In many instances the ashpit is too palpable. It is just at the entrance of their doors. The inmates are laid on their backs. This is one source which has certainly undermined health, if it does not produce a particular and special disease.

12,452. Then you think that ashpits, as well as cesspools, under and adjoining dwellings are sources of ill health?—No doubt of it, in those crowded localities where exhalations come into the windows of houses and penetrate the doors. I am bound to say that Mr. Magson, the inspector of nuisances, is most exemplary in his duties, and I am not aware of anything like such bad exhalations as used to be the case in years gone by.

12,453. Notwithstanding that care and attention on the part of the corporation, do you still attribute ill health to the presence of these ashpits?—I do in part.

12,454. Would you recommend that waterclosets, or some other means, should be substituted for ashpits?—Yes, where manageable, and good tubular drainage. But the 960 waterclosets referred to by the town clerk are principally in the houses of the better classes of occupiers whilst the poor people must join in a large pit which is constantly either overflowing or giving off exhalations and malarious gases.

12,455. When these ashpits have been placed at some distance from the residence, have you found them a source of ill health?—In some cases the vapours get greatly diluted, and I do not know that in the case to which Colonel Sibthorp used to refer there is any formidable objection. I mean the case of a privy of the ordinary kind in a garden at a distance from the dwelling with ordinary and due care being taken as to the removal of the refuse.

The witness withdrew.

Mr. Samuel Magson (Halifax) examined.

12,456. (*Chairman.*) You are the sanitary inspector of the borough of Halifax?—I am.

12,457. How long have you held the office?—About 15 years.

12,458. Have you any assistance in that office?—I have now a foreman over the scavengers, and an assistant.

12,459. How many scavengers have you under your charge?—Twenty-three.

12,460. How many ashpits have you to deal with in the borough?—The whole of the ashpits are not under our care, but only that portion of them for which the parties think fit to come forward and pay, but there is a loss upon what they pay.

12,461. In cleansing those ashpits do you cause a nuisance in the way of smell?—Yes.

12,462. Do the people ever complain of that nuisance?—They do.

12,463. Have you ever known fever cases in the houses bordering upon and near to those ashpits?—Yes. I have known cases of fever, particularly in confined streets or courts.

12,464. Do you know any of the parish medical officers?—Yes.

12,465. Do you know the relieving officer?—I do.

12,466. Do you ever see him in those bad districts where those ashpits are the worst?—I have sometimes seen him going about visiting the people who receive relief in those districts.

12,467. If fever prevails in the town where does it generally prevail?—The upper portion of Halifax is more subject to it than the lower portion.

12,468. Has it always been so since you have known the town?—It appears to be regularly so.

12,469. How do you account for that?—For instance, we have a portion of the town called Mount Pleasant, and the system of drainage had not been thoroughly carried out there. That, I think, is one reason, and another reason is that Mount Pleasant stands high, and just catches the wind from the north-east, while the lower portions of the town seem to be protected from the east wind by Beacon Hill. From my observation those are the causes. In fact, in going through the death rate with the registrar one day we found that even death is more prevalent in the upper portion of the town than in the lower.

12,470. What are the deaths principally from? Are they from fever, or from consumption, or from what?—The registrar does not return the names of the disorders.

12,471. Is any portion of the Hebble water used for irrigation?—From the end of the river Hebble water is taken on to property belonging to Mr. Akroyd, the gentleman who gave evidence here.

12,472. And used for irrigation?—Yes.

12,473. For ordinary grass land?—Yes.

12,474. Is the process productive?—Yes, so the farmers have told me.

12,475. Have you had any report of its causing fever?—I never heard of it until Mr. Akroyd mentioned it in his evidence.

12,476. No person has complained to you about it?—It is out of my district.

12,477. You never heard of it until now?—No.

12,478. What are the first works upon the stream?—Mr. Shaw Slater's works, where a liquor is extracted from wood. There is a goit, and they appear to throw the refuse down the goit.

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12,479. And the refuse passes down the stream?—Yes, and it will get on to the land because they irrigate from the goit.

12,480. Are any privies and ashpits so situated that the refuse shall fall into the stream?—Yes, many; they begin at Salter Hebble; there are two privies and an ashpit so constructed that the refuse slides down into the stream.

12,481. Have you any power to interfere with that as a nuisance?—No; we have some similar ones in the borough; we brought the matter before the committee, and the owners seem to have intimated their right to do as they please; they have done it for a long time, and they do the best they can by covering it with flag; but they always say, "You throw the refuse of your "waterclosets into the stream, and we do no more."

12,482. Do any parties whom you know pass their ashes into the stream?—The cottagers do so all along the stream; some of the houses are so contiguous that they put up the sash, and throw the ashes out into the water.

12,483. So far as you know do any manufacturers do so?—I do not know any who do it now, but I have been during the present week up and down the whole of the streams, and there are ashes which look very suspicious on the bank; they are placed very conveniently for going into the stream.

12,484. Some of them might accidentally get in?—I am inclined to think that they get in when we are in bed. I have been very minute in the examination; they do it very cunningly and there are no traces of the ashes.

12,485. (*Mr. Harrison.*) Excepting in the bed of the river?—Exactly.

12,486. (*Chairman.*) What is lower Siddle Hall?—The sewage of the cottages there comes down the river.

12,487. And there are some chemical works, the refuse of which goes into the water?—Yes, the waste drain empties into the Hebble.

12,488. Then there are privies which empty into the stream?—Yes.

12,489. There are small gasworks, does any refuse from them go in?—I questioned the fireman and he says that they sell it. On inquiry at most of the gasworks I find that there is such an anxiety for the liquor and tar, that there is no occasion to throw it into the stream.

12,490. The refuse of the lower Shaw Hill mill goes in?—Yes.

12,491. Are any ashes thrown in there?—Yes; cottage ashes.

12,492. Is there any other refuse?—There is the refuse of a grease extracting work there, and within a day or two for the first time I have had a complaint about a most noxious smell at those grease works, and from my experience at other grease works, I think that the man is not thoroughly acquainted with the mode of doing it. Some years ago we had complaints respecting several firms, and they put their heads to work in order to carry on their trade without causing smells, and of late we have had no complaint about them.

12,493. You have a drain near Whitegate which passes into the brook?—Yes.

12,494. And there are two privies at Taylor's Bridge?—Yes.

12,495. Refuse liquid from some other works goes in?—Yes.

12,496. The main outfall empties itself into the brook?—Yes.

12,497. The drainage from the Caddifield district enters the brook?—Yes, there is a small district.

12,498. Then there is refuse from chemical works?—Yes.

12,499. And from works near the "Ship Inn?"—Yes.

12,500. There is refuse from Messrs. Whitehead's wire mill?—Yes.

12,501. And from the Albion Mills belonging to Messrs. Robert Crossley?—Yes.

12,502. There are two privies there?—Yes.

12,503. Then there is the refuse from the works of Messrs. Thomas Crossley and Company?—Yes.

12,504. I suppose that this list which you have handed in is a correct list of the class of refuse which goes into your river and brook?—Yes, with some qualification. As regards one or two gasworks which are named, I find upon strict inquiry that they are disposing of all their liquor and gas tar, but still there is evidence that it has gone in.

12,505. Within a recent period?—The tar is there in some places.

12,506. And I daresay that you have had complaints from manufacturers that their cloth is seriously injured if refuse tar gets on?—Yes, frequently.

12,507. Do you know anything of the mills beyond your borough?—Yes.

12,508. Do any manufacturers outside the borough throw in their waste refuse?—The ashes up in that neighbourhood are in a suspicious condition.

12,509. You mean suspiciously near the stream?—Yes; but I must also say that when we get above Pillings' dyeworks at Lee Bridge, the water is comparatively pure; and also above the works of John Crossley and Sons in Old Lane the stream seems to be pretty pure.

12,510. Do you think, so far as you know the district, that there would be any serious difficulty in all parties being compelled to keep their refuse out of the stream?—I do not; particularly the solids.

12,511. As to the fluid refuse, that is a question upon which you would not offer any opinion?—No, I am not enough of a chemist.

12,512. As regards solids, such as ashes and even privy refuse, if a large mill can keep out all its refuse, a small cottage may do so?—Yes; I think that it is decidedly necessary that some law should be enacted, or that there should be some supervision of greater force than we have, to stop all those solid matters from going into the stream.

12,513. Do any chimneys in Halifax smoke?—Very much so, many of them.

12,514. Do you think that if you were authorized to look after those chimnies, and if the law was powerful enough, you could induce the proprietors of them to prevent those chimnies from smoking?—I make regular inspections at intervals and report to the sanitary committee upon them. I have heard the evidence of Mr. Rawson given this afternoon, and I quite concur in his views relative to the application of Jukes's patent in this neighbourhood, for this reason, Messrs. Crossley have a chimney which has no other boiler than Jukes's patent, and I can observe that chimney for hours together and not see smoke come out of it; now and then, when I have made observations, there has been perhaps for half a minute of time a light smoke, but I have put it down, more to show the difference which I have observed than to indicate any quantity which has come out (*the witness produced a diagram and explained it*).

12,515. You think that trade might be carried on by well-adapted and simple means without making smoke?—I do, and perhaps it would not be unwise to add that Mr. Bailey, who was lately engineer to Messrs. Crossley's great carpet works, was decidedly opposed to Jukes's process, not on the ground that it did not consume the smoke, but on the ground that it was more expensive; but just previously to leaving he told me that they had arrived at a point at which it was rather a saving than otherwise; he has since left their employ and gone into business for himself.

12,516. Then your experience would lead you to the conclusion that that apparatus may be worked so as to prevent smoke, and at all events not to be more costly than the ordinary process?—Yes, that is from the evidence of practical persons; I have not tried it myself.

12,517. But you have watched the chimney tops?—Yes.

12,518. Do you know Messrs. Rawson's works?—Yes.

12,519. They do not make any smoke?—No; I have also observed Messrs. Edwards' works and also

the works of the late Colonel Polland in Wheatley. I went down to Wheatley and had some conversation with the engineer there, Mr. Law, who has the management of the work, and I asked him whether he would like to go back to the old process? "No," he said, "I am a gentleman compared with what I "used to be, and I am certain that we produce more "power with less coal than we did before." Relative to the other mode of firing, some 12 months ago Messrs. Crossley were very much complained of to the committee by myself in my reports and they seemed to be at a loss what to with their firers, the idea struck me one day that to try the men I would let them know as a secret through another person that I was going to observe, he went and did so, and on that day from that chimney for an hour and a half I could not see a streak of dense smoke, it was fired merely by hand.

12,520. But they knew that you were watching?—Yes, because I had sent somebody to tell them so. The result of it was that the ex-mayor and myself were deputed to go and see the principals upon the subject, and Dr. Wightman explained to Mr. Joseph, who has that department in hand, what we had done, and he went with us to the firemen. The man who was there said, "I can do nothing with these firers, "and I must have an entirely new set of firers to do "what you want." I said, "Perhaps these men will "do it if they have encouragement to do it," and Mr. Joseph said, "I like that idea, and so long as they "keep the volume of smoke down below what the "corporation allow, I will give them 1*s.* more a "week, and if they get above it I will deduct 6*d.*" Since then that chimney has not made half the smoke which it made before, and I inquired the other day, and I believe that the men are still in the receipt of their 1*s.* a week, and that is a great improvement (I think it justice to state that) upon the old mode of firing.

12,521. Then you think that it is quite as much a question of the fireman as of any special arrangement?—I would not go quite so far as that. I believe that Jukes's process is better for this reason, as Mr. Rawson has said, namely, that you have not to depend upon the fireman. In this part of the country, where there are little manufacturers, the engine tenter has to oil and look to the shafting, and so on, and in that case Jukes's process would still be doing its work, whereas without it when he goes away he is obliged to throw on a great quantity of coal, and, as you have explained to-day, that is a great cause of smoke, and then he goes and stirs up of the coal and there is a big volume of smoke. I think that Jukes's is the preferable plan. I may also state that I was deputed some time ago by Mr. Alderman Battison to go to the great paper works of Messrs. Wrigley, near Bury. We had heard of a great improvement introduced there, viz., hollow grate bars admitting air in front, and letting it out behind, just under the bridge. Before going near their works, we made observation upon two large chimnies of some 60 or 80 yards, and the result was very satisfactory, considering the amount of power which they had; it was nothing like so bad as in some places. When we got to the establishment of Messrs. Wrigley we found that they had 12 forty-horse boilers working night and day. They took us through the works and showed us the apparatus, and they seemed very much satisfied with Biggs's patent of hollow grate bars, but Mr. Alderman Battison and myself were of opinion that nothing was equal to Jukes's patent.

12,522. Have you not heard that Jukes's patent can only be applied to a circular boiler with the fire underneath?—Yes.

12,523. And that the modern process places the fire within the boiler?—Yes, I am quite aware of that. I am now speaking of smoke consuming and not as to saving fuel or heat.

12,524. You know what parliamentary smoke is?—Yes.

12,525. It is smoke which you can see through?—Yes.

12,526. Have you anything further to add?—I think that in all towns, particularly those which are situated as Halifax is, independently of sewerage, the bed of the river ought to be paved.

12,527. As they have been doing in Bolton and Blackburn?—I was not aware of that; I have stated that people living near the stream do not appear to suffer so much, but I think that is in consequence of the effluvium rising and getting to the upper parts of the town, and that persons on the immediate stream do not suffer. There is another thing which I should wish to add, namely, that I believe that if it was not for the chemicals of the dyers going into the drainage we should have a great deal more disease.

12,528. You think that the chemicals act as disinfectants and prevent the sewage matter from being more noxious than it otherwise would be?—I do. There is another thing, namely, that where there are no proper means of purifying sewage I think that privies are far preferable, and I think that earth closets (which I have not seen) would be far preferable to any watercloset system, unless there was some system of purifying the sewage before it went into the river. We find that in Halifax we have a very great difficulty in the old ashpit system, and no doubt there is a great deal of disease generated from our rude mode of carrying on ashpits and privies. Of late years, with the practice which I have had, I have found that ashes are a deodorant, and with our present system of drainage I have discouraged waterclosets wherever I could, particularly among the poorer classes, and for this reason, they get out of repair from children going, and so on, and they get to be a much greater nuisance than privies. When privies become a nuisance there is a mode of getting rid of the refuse, but in the case of waterclosets, they are neglected, and there is a bad smell, and the people suffer, and they do not know what from. I sometimes find that they are weeks or months suffering from the bad effects. Frequently in the case of respectable houses I have been called in, and have found that the waterclosets have been entirely untrapped and have been ventilating into the houses.

12,529. Your surveyor has told us to-day that your sewers are not ventilated?—They are not except by the house falling spouts means of ventilation. I have had an idea in my own mind for some time of ventilating the sewers. I do not know the patent which has been obtained, but I think that our mill chimneys would make first rate ventilators to main sewers. I have thought that an arrangement might be made by the corporation paying an acknowledgment, and that those sewers which are at the upper part of the town connected with the mills and furnaces, would be much better ventilated in that way than by any other system. That is an idea of my own.

12,530. In the city of Carlisle we connected the sewers with the mill chimnies in six or seven cases. Of course the first consideration of the millowners is to maintain their own draught, and every extra inlet into the chimney diminishes their draught. If they would let you pass a 9 or 10-inch flue into the chimney it would be good, but it would not be so good as making numerous ventilators throughout the town. You would not be safe trusting to mill chimneys alone without other means?—I am very much obliged to you for making that statement.

12,531. (*Mr. Harrison.*) When new buildings are erected have you any supervision as to the ashpits?—There is an improvement committee of the corporation, and all building plans go before that committee and before the surveyor. Of late the corporation have taken great pains not to allow anybody to build conveniences over the river, but of course they allow privies, and they are now constructed in most cases so that the ashes will mix with the night-soil. A great evil in Halifax has been in having ashpits placed beyond the row of privies; there is a little hole, and the ashes are just dropped in and never get near the soil, and the soil exposed to the rain and sun has caused a great nuisance; but that matter has been

HALIFAX.

Mr. S. Magson.

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looked to lately, and the ashes have been put upon the night-soil.

12,532. In the case of those ashpits which have been constructed under the inspection of the borough surveyor, have you found any injury arising to health?—No; whenever I have found ashpits so constructed that the ashes could get upon the night-soil the privies have been almost completely deodorized as compared with others. There is another thing which I wish to mention, namely, that in many parts there is a sort of natural giving in of the ground, and many of those places have had to be drained, otherwise the water begins to ferment and becomes a very great nuisance.

12,533. If there are ashpits of that kind, it becomes of great importance to keep all the water out of them?—It does.

(*Mr. Norris.*) There is one circumstance connected with Mr. Magson's evidence which I should like to get upon the notes, namely, that by our bye-laws we do not allow any privy to be erected within five feet of any door.

The witness withdrew.

Mr. G. D. Malam.

Mr. George Dunbar Malam (Halifax) examined.

12,534. (*Chairman.*) You are manager of the Halifax Gasworks?—Yes.

12,535. Do they belong to a company?—They belong to the corporation.

12,536. Where are they situated?—They are situated partly on the banks of the Hebble at the foot of Beacon Hill.

12,537. How many retorts have you now in use?—238.

12,538. What is the cubic volume of gas which you produce annually?—Close upon 160,000,000 cubic feet.

12,539. What weight of coal per annum do you use?—About 17,000 tons.

12,540. What kind of coal?—Lancashire cannel, Yorkshire cannel, and Yorkshire coal.

12,541. Do you use earthenware retorts, or iron ones?—They are all earthenware.

12,542. What weight of tar do you make per annum?—Nearly 900 tons.

12,543. What weight of ammoniacal liquor do you make?—About the same quantity.

12,544. Have you any difficulty in getting rid of your tar and ammoniacal liquor?—Not the slightest, we sell it all.

12,545. What do you get for your tar?—18*s.* 6*d.* is the highest price to the contractor, but the burgesses I believe pay something more. I think that 1*l.* per ton is the highest price.

12,546. What do you get for your ammoniacal liquor?—That is taken in bulk.

12,547. What do you get for it per annum?—365*l.*

12,548. What do you purify with?—Oxide of iron principally.

12,549. Do you use oxide of iron exclusively?—We mix a little lime with it.

12,550. What amount of refuse have you per annum from the lime?—The materials are all mixed up together, and the refuse is taken away by the person who supplies us with the oxide, in order to manufacture sulphur.

12,551. Then you have no refuse from purifying upon your premises?—Not at the present moment; in the last two or three years we have had probably 200 or 300 tons of refuse oxide.

12,552. Because the manufacturer did not choose to take it away?—Just so.

12,553. Have you made a bargain with him to take it away?—I do not think that there is any bargain with him that he shall take it away, but I think that it is optional.

12,554. Is it a nuisance while remaining?—Not at all.

12,555. Is the lime a very great nuisance?—Yes, because sulphuretted hydrogen would be evolved into the atmosphere.

12,556. Is there any refuse in your manufacture which you cannot dispose of?—None at all.

12,557. Do you pass anything whatever into the streams or sewers?—Not now.

12,558. Did you do so some years ago?—Two or three years ago we did.

12,559. Neither tar, ammoniacal liquor, nor any solid refuse now passes into the stream?—No.

12,560. What amount of coke do you produce per annum?—Between 7,000 and 8,000 tons for sale.

12,561. Do you find a ready disposal for it?—Occasionally we do, when the weather is suitable for the consumption of fuel.

12,562. You use a portion of it for your own processes?—Yes.

12,563. I suppose that you distil your coal by it?—Yes.

12,564. Do you make any smoke on your premises?—No.

12,565. No smoke passes from your chimney?—No.

12,566. How frequently do you find it necessary to change the water in the gas tank wells?—We do not change it at all. The only instance where any tank is emptied would be in the case of telescoping a single lift as was done I believe two years ago.

12,567. You do so only in the case of some radical alteration being required?—Yes.

12,568. What is the net profit which you make for the corporation in your manufacture?—I am informed by the borough accountant that the gross profit is upwards of 11,000*l.* a year, and that the net income is about 4,000*l.* a year.

12,569. What do you charge consumers for gas for shop purposes; how much per 1,000 cubic feet?—4*s.* in the borough; then there is a discount.

12,570. And your larger consumers have it for less?—Yes, I believe that the lowest price comes down to 3*s.* 2½*d.*

12,571. Have you ever applications from residents in the neighbourhood for you to allow them to bring their children into your purifying house when they have croup or measles?—Yes, very often.

12,572. What are the diseases for which they think it good?—They think it good for croup.

12,573. Are many children brought to be put into the purifying house?—Yes; at certain seasons of the year. I think that they come principally in the winter time.

12,574. Do you think that it does them any service?—No doubt of it.

12,575. Are your men a healthy class of men?—Undoubtedly so; they are free from almost every form of disease except what they bring upon themselves by inebriety.

12,576. So far as your knowledge and experience goes there is nothing injurious to health in the manufacture of gas?—I have lived all my lifetime either on gasworks or next door to them, and I do not consider myself an unhealthy man, or unable to do a day's work with any man of my own age.

12,577. Do you observe any nuisance?—No; there may be a nuisance to a stranger. Occasionally there is a little nuisance when the purifying vessels are first opened; there is then a slight trace of sulphuretted hydrogen, and of course that is not pleasant.

12,578. How long has the practice existed of mothers wishing to bring their children into the purifying house?—I have known it since I was a child.

12,579. Are more children brought now than were at first?—No, I do not think that people know the value of it, or else they would avail themselves of it more than they do. You may have seen it stated in the newspaper, that some Parisian doctor has lately referred to the use of it as if it was some new discovery, whereas it is as old as my recollection.

The witness withdrew.

HALIFAX.

Mr. J. Beaumont.

17 Nov. 1866.

Mr. JOSEPH BEAUMONT (Elland) examined.

12,580. (*Mr. Harrison.*) Are you a manufacturer?—No, I am a finisher of woollen cloths, and we require clean water for our purposes.

12,581. Where are your works situated?—At Elland.

12,582. Is that on the banks of the Calder?—Yes.

12,583. Is it below the confluence of the Hebble and the Calder?—Yes.

12,584. Does the Calder and Hebble Canal pass near your works?—Yes.

12,585. Is the water with which the Hebble Canal up to Halifax is supplied pumped from the river Hebble?—Yes.

12,586. Does that water contain the sewage of Halifax besides other impurities?—Yes.

12,587. Is there a deposit in the canal from that water?—Yes.

12,588. How do the canal company get rid of that?—We should not complain if they did not continue the open sluice sometimes for 12 or 14 days in succession, during the whole of which time we have dirty water; we suffer so greatly from it that we might as well give up our business during that time.

12,589. How frequently does such an interference with your trade occur?—Every summer.

12,590. Are you dependent upon the water of the Calder for washing your goods?—Entirely.

12,591. And this occurs every summer for about 14 days?—Yes, and it is not only that, but they have sluices on various parts of the canal above us, and at certain periods they open those sluices and send down the water by sludging or dragging to the mouth of the sluice.

12,592. How many hands have you employed at your works?—We are fulling millers; we employ about 20 hands.

12,593. And for the time which you have mentioned those hands would be all thrown out of work?—The water has been so very dirty that we have had considerable complaints with respect to our goods.

12,594. Is it sometimes sent down without your knowledge so that you go on using the water?—Entirely so; they have not given us any notice.

12,595. Therefore you are interested in some remedy for the present pollution of the rivers and of the canal adjoining?—Especially so; the river Calder is at a certain time in summer a boiling stinking mass which everybody has to pass in going over Elland Bridge in order to get to the railway station. We receive not only that but all the Halifax sewage.

The witness withdrew.

Adjourned to Monday next at 10 o'clock, at Todmorden.

Todmorden, Monday, 19th November 1866.

PRESENT:

ROBERT RAWLINSON, Esq., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, Esq.

TODMORDEN.

Mr. W. Sutcliffe.

19 Nov. 1866.

Mr. WILLIAM SUTCLIFFE (Todmorden) examined.

12,596. (*Chairman.*) Are you a resident in Todmorden?—Yes.

12,597. Do you carry on any business here?—I am a corn miller.

12,598. Where is your mill situated, how far from the town?—About half a mile, it is Stansfield Mill.

12,599. Is it above or below the town?—It is below the town, on the Halifax Road.

12,600. What amount of power do you use?—I employ two 12-horse engines and a water-wheel.

12,601. Of what power is the water-wheel?—I have not had that tested.

12,602. What number of stones can it drive?—At first it drove seven pairs of stones; I can now drive about five.

12,603. What power does it require to drive the stones?—Some corn millers estimate that it requires 3-horse power, and some 4; but it will depend entirely upon the amount of feed upon the stones.

12,604. It is not so low as 2½ horse power?—No.

12,605. How many dressing machines do you drive?—I have two silk-dressing machines; they do not require much power; I have six pairs of French stones, and a pair of grey stones for Indian corn or oatmeal.

12,606. How long has that mill been established?—The present mill was built, I believe, in 1804; but there was one prior to that.

12,607. How long have you been lessee of this mill?—I am owner, and have worked the mill ten years.

12,608. You said, I think, that you have not so much water power now as you had formerly?—I have not.

12,609. Has the mill-tail goit sometimes been choked up?—The last winter the Todmorden gas company threw in all their ashes into the river at the outlet of my tail goit, and they have raised the tail goit, and the bed of the river has been raised lower down.

12,610. Did you remonstrate against that?—Yes, I brought an action against them, and obtained 150*l.* damages.

12,611. Did you consider that that was as much as you ought to have had for the damage you had sustained?—No.

12,612. You would rather have had your power not interfered with?—Yes, I should have preferred that.

12,613. (*Mr. Harrison.*) I presume the gas company are restrained from running their refuse into the river?—They have not done it since I got the verdict.

12,614. How is it that your power is now reduced from seven pairs to five pairs of stones?—The reduction is in consequence of the deposit lower down the river, below the gasworks.

12,615. Have you taken any steps to prevent that?—The law proceedings have not yet terminated.

12,616. Have you brought any actions against other parties besides the gas company?—No, I have not.

12,617. What amount of coal do you burn at your steam mills?—It is very uncertain; it depends upon the supply of water.

12,618. Do you burn 50 or 100 tons in a year?—I cannot say.

12,619. Do you burn 50 tons?—It depends entirely upon the water.

12,620. Whatever the weight may be, what do you do with the ashes?—I use them to repair roads, and for draining purposes; I have never put any into the river.

12,621. Do you put any refuse of any kind into the river?—Some six or seven years ago, when I cleaned out my head goit, the refuse that had come out of the river into my head goit I put back into the river below my weir.

12,622. Do you consider that the introduction of general restrictions against putting solids into the river would be a great hardship?—I do not presume that it would be, as far as I am concerned.

12,623. If all persons were compelled to keep their refuse out of the river, you would not object?—Not at all.

12,624. What amount of costs did the law proceed-

TODMORDEN.

Mr. W. Sutcliffe.

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ings entail upon you?—I have not yet received the account; but I do not think that the 150*l.* will cover my costs, besides the annoyance.

12,625. It was the case of one neighbour prosecuting another?—Yes; and I would rather not do that, if I could avoid it.

12,626. Are not ashes and refuse thrown into the river above you by other persons besides the gas company?—Yes.

12,627. Is it not a general practice here to throw solids into the river?—Yes; the river is the common receptacle for everything.

12,628. Road scrapings, and all?—Yes.

12,629. At the bridge there was a great collection of cinders, which the flood has partly taken away?—Yes.

12,630. Did not those cinders come from the dwelling houses?—I presume so.

12,631. Have you been flooded during the last week so as to stop your works?—Yes.

12,632. Are you frequently stopped in that way?—No; the water ran through my mill nearly all that day. On Friday last I was prepared for it; one of my men called myself and my sons up about 5 o'clock in the morning, and we cleared the mill bottom, or I might have been seriously damaged. I had a large amount of flour in the mill bottom.

12,633. It would cost you a considerable sum, I suppose, to clear the mill?—I had to pay all the men for Friday last, for merely looking after the flood.

12,634. Do you think that the flood was higher than it would have been, from the river having gradually silted up?—No question of it.

12,635. If the same thing goes on, I suppose the river will naturally silt up still higher?—No doubt. In some places it has silted up very much now; I can see it now that the flood waters have abated.

12,636. Have any other manufacturers suffered from the flood?—I believe they have.

12,637. Did the water come into the mill floors?—Yes.

12,638. What accommodation have you provided for your men in the shape of privies, or ashpits?—I have none about the mill.

12,639. Where then do the men go?—There is a privy up at the cottages above.

12,640. Is that refuse passed into the river?—No, it is not; it is carted on to land.

12,641. Have you observed, since the late flood, whether the bed of the river is altered below your mill?—Opposite to my mill it is higher than it was prior to the flood.

12,642. Has the water tailed back against your water-wheel, in consequence?—I have not paid particular attention to that this morning.

12,643. The bed of the river, you think, has been raised?—Yes, opposite my mill; but the outlet of my tail-goit is considerably below it.

12,644. It is generally supposed that a flood clears out a river, but your experience is that the recent flood has raised the bed of the river at one point?—Yes.

12,645. The tendency is to clear it away in some parts, and to form banks in others?—Yes; it may clear it away in one part, and deposit it in another.

12,646. The result of such an operation is, to increase flooding upon adjacent land?—Yes.

12,647. Was much land below Todmorden flooded?—The whole valley.

12,648. Is land injured by flooding?—Unquestionably, there is a great deposit of mud and sand.

12,649. And all kinds of refuse?—Yes.

12,650. Will that injure meadows for some time to come?—Yes; before grass can get through this deposit will have to be scraped away.

12,651. (*Chairman.*) Do you know what quantity of rain fell last week, on the days which preceded the flood?—No.

12,652. Have you no rain gauge at Todmorden?—No.

12,653. Do you know what height the flood rose from the lowest level up to the highest; did it rise as much as 10 or 12 feet?—No; I should think not so much as that, but from six to nine feet. I have not measured it.

12,654. Was it a greater flood than you remember before?—No; I think I can remember as large a flood in my time.

12,655. When was that?—Perhaps 20 or 30 years ago.

The witness withdrew.

Mr. John Buckley (Todmorden) examined.

Mr. J. Buckley.

12,656. (*Chairman.*) What business are you engaged in?—I am a boiler maker.

12,657. Where are your works situated?—At Gorksall.

12,658. Upon the banks of the river?—Not exactly.

12,659. Are you affected by the river at any time?—Not at all.

12,660. How many men do you employ?—32.

12,661. Have you any privies or ashpits on your premises?—Yes.

12,662. Are their contents emptied into the river?—No; we cart them away.

12,663. Were you affected by the flood during the last week?—No.

12,664. Are you a member of the local board here?—Yes.

12,665. Do you know whether the local board has anything to do with cleansing the river?—I am not aware of it.

12,666. Have any questions been brought before you and discussed as to solid matters being thrown into the river?—The subject has been occasionally mentioned.

12,667. Ashes and road scrapings are thrown into the river, are they not?—Yes.

12,668. Do the men who work upon the roads for the local board throw road scrapings into the river?—I cannot speak to that; the local board does not scrape the roads, that is done by the highway surveyor.

12,669. Has not the local board charge of the roads?—No, not particularly.

12,670. (*Mr. Harrison.*) Do you use steam power?—Yes.

12,671. What do you do with the ashes?—We throw part of them into the river.

12,672. (*Chairman.*) Has any person remonstrated with you for doing so?—No.

12,673. Do you know what weight of ashes is thrown into the river in a year?—Not exactly; we do not throw in much.

12,674. Is there any difficulty in keeping them out?—The only difficulty is to find a place for them; I should not know where to cart them to.

The witness withdrew.

Mr. Robert Fielding (Todmorden) examined.

Mr. R. Fielding.

12,675. (*Chairman.*) What is your business?—I am a spinner and manufacturer.

12,676. What is the name of your works?—I have Birks Mill and Hoyle Bottom Mill.

12,677. Are they both on the river?—Not exactly; they are neither of them close upon it.

12,678. Where do you get your water from?—From the land above.

12,679. How many hands do you employ?—I cannot tell, probably 250; mine are cotton mills.

12,680. What weight of coal do you consume in a year?—I do not know.

12,681. What is the power of your engines?—We have two 20-horse engines.

12,682. What do you do with the ashes?—Some-

times we throw them into the brook, and sometimes we cart them away.

12,683. Then you just do as you like with them?—Yes.

12,684. Have you privies and ashpits, or water closets, at these mills?—We have privies.

12,685. Does any of the refuse go into the river or brook?—Not that I am aware of.

12,686. Do you cart it all on to the land?—Yes.

12,687. Do you think the river is a proper place to put ashes in?—There is nowhere else here to take them to; some folks have no land to carry them to.

12,688. There is a railway is there not?—Yes.

12,689. Cannot they be taken away by the railway?—Yes, but that would be an expense.

12,690. (*Mr. Harrison.*) Do you think that the ashes you throw into the river deposit themselves in the bed below, and cause a nuisance to those who own water power and who have meadows on the banks?—There is no doubt that ashes so thrown in are the means of injuring parties below.

12,691. Would it not be right, therefore, that people should keep them out, and not injure others below?—Yes, but there are water weirs besides.

12,692. Do they stop ashes and other things?—No doubt they will.

12,693. If there were no ashes to stop of course they would not stop them?—No.

12,694. Do you think that the injury caused by the flood last week all down the valley was considerable to adjoining lands?—No doubt it was considerable.

12,695. And to mills?—Yes.

12,696. Has it not cost individuals all down the stream a considerable sum of money?—Yes.

12,697. Some lives have been lost?—Yes.

12,698. Any occurrence of this kind which raises the bed of the river and floods the adjoining land, causing at the same time bridges to be carried away, endangers not only the property on the banks but the lives of persons living there?—Yes.

12,699. Considering these things, do you not think that the government should take some steps to prevent solid refuse being thrown into the river?—No doubt it would be a benefit if there were a place provided to deposit ashes upon, but there is an immense quantity of wrack, or solid refuse, that comes down; thousands of tons in a year, which come down from the mountains in the shape of gravel and sand.

12,700. Is there much washed out of the quarries?—I should say not so very much out of the quarries, for they are at a distance.

12,701. Is there not a quarry below the town, and pretty close to the river?—Yes, there is one, but there is the canal between.

The witness withdrew.

Mr. Abraham Stansfield (Todmorden) examined.

12,702. (*Chairman.*) In what business are you engaged?—I am a nurseryman.

12,703. Where are your grounds situated?—About 300 yards from the side of the river.

12,704. Are your grounds liable to be affected by the river in time of flood?—Yes, they are.

12,705. Were your grounds flooded at all last week?—Yes, very seriously in the lower part of the nursery.

12,706. To what depth were your grounds covered with water?—From 18 inches to two feet deep at the bottom part.

12,707. Has the flood left a deposit of sand on the ground?—It has covered great plots of rhododendrons with mud, and the leaves are the colour of the road instead of being green; it has left a great deposit of very fine mud.

12,708. What do you think the damage will be to you individually by the flooding?—I do not think it will be very excessive, but we have suffered in the house as well as in the nursery, in the cellars; the cellars and kitchens have been very much flooded.

12,709. How long have you known this river?—For 55 or 60 years.

12,710. In that time has the trade of the district increased largely?—Yes, immensely; large cotton mills have grown up.

12,711. Is it the practice in Todmorden to throw ashes and solid refuse into the river?—It is, I believe, very generally.

12,712. Has that a tendency to lift up the bed of the river and fill the channel?—Not a very material tendency; I think the solid refuse would be carried away far off if the banks were kept up; it is the ruinous condition of the banks and the lowness of them that cause the filling up of the channel, for as soon as the debris gets down to a place where the water overflows the banks, the water breaks through the banks, and the refuse, instead of going down the stream, is left in the bed of the river and cannot be carried away.

12,713. The injury caused is not so much by filling up the bed of the stream as by breaking down the banks?—No, not so much; but the banks breaking down, and the pressure being taken off by the water flowing over on to the land, all the debris remains deposited which would be carried away if the water was kept in its right course.

12,714. Do you think that you would be justified in throwing solid refuse into the river, because it did not stop here?—No, I should be against putting anything of that sort in on many grounds, and one is that I think it is desirable that our river should be kept pure. I remember the time when there was abundance of fish here, now there are none; in consequence of the materials that are thrown in, the nastiness of the stream is prejudicial not only to the lives of fish, but generally, no doubt, also to the health of the people.

12,715. Do you not think that if 20,000 tons of refuse are thrown into this river, and none of it stops here, the probability is that the refuse settles somewhere else below?—Certainly.

12,716. It would tend to raise the bed of the river where the fall is not so steep as it is here?—Yes, at some points, where the channel is broad.

12,717. Although you might not experience the evil effects here, persons down below would where the river course is flatter?—Yes, unless the banks of the river were kept up, so that the water could be kept in; if so, I think it would go to the ocean, through the great estuary of Yorkshire; the force of the stream would increase the lower you go down, but as soon as the pressure is taken off by the water flowing over on to the fields, then the force of the water cannot carry the materials forward.

12,718. Are you aware that the bed of the river Ouse has gradually risen within the memory of boatmen working upon it?—No, but I have no doubt it is so in places where the channel has not been kept narrow.

12,719. Have you a rain gauge upon your premises?—Yes.

12,720. Do you know what amount of rain fell last week?—From Thursday morning till Saturday morning there were 3·94 inches.

12,721. Have you ever registered so heavy a rainfall before?—Never in the same time.

12,722. How long have you had a rain gauge?—We have only kept it registered for two years.

12,723. (*Mr. Harrison.*) How often do you record the rainfall?—Sometimes every day; not always; on Friday it was recorded. A record should have been made for Thursday, but it was so wet that no one would venture out, and the rain went on for 48 hours.

12,724. Can you give the rainfall for two years here?—Yes, I can. We are in connexion with the Bacup meteorological people, where they keep rain gauges, and we send our accounts there.

12,725. Have you observed whether when there is a certain amount of rainfall the water floods the adjoining land where you live sooner than it used to do?—No, I do not know that it does; I have not observed it. We should not have been flooded on this occasion if the banks of the river had been kept entire. It was entirely in consequence of the break in the banks of the river.

TODMORDEN.

Mr. A. Stansfield.

19 Nov. 1866.

12,726. Is it the duty of the local boards, or any persons, to keep the banks in order?—I think not. It is everybody's duty, and of course it becomes nobody's.

12,727. Would it not be advantageous if it was somebody's duty to see that the river was kept in order?—There is no doubt of that. It would be a benefit to every one if it were judiciously done, with economy and care.

12,728. Have you observed that the meadows all the way down are covered with debris?—Yes.

12,729. Is it your opinion that the damage done by the flood of last week was considerable?—Yes, very considerable. I should mention that the debris which is brought down by the river is not of a fertilizing kind. There are many little pebbles and much coarse sand and grit. It is not that fine calcareous mud that you meet with in limestone countries.

12,730. It is not like giving a warping below?—No; it is an injurious thing, and the mud has to be removed.

12,731. How do you manage in a case of this kind to set to work and remove that sand?—Men take it away in barrows where it is very thick; where it is thin they spread it over.

12,732. (*Chairman.*) Do they take it back to the river?—I should say not; but it may have been the case.

12,733. (*Mr. Harrison.*) After going to an expense to remove the sand, will much injury be done to the grass; will it recover itself next season?—I think there will be no material damage done if the sand is removed properly. I think it is a very important matter that fæcal matters should be kept out of the river.

12,734. Is it the common practice to place privies on the bank of the river, and so dispose of the refuse?—Yes, in many cases it is so; but in many cases the privies are emptied. We have a custom in some parts of the town, indeed the local board insists upon it, that the privies shall be provided with boxes.

12,735. Are you a member of the local board?—Not at present; I was formerly. Privies are provided with loose boxes, and these are kept in the petties until nearly full, and then they are taken away. In some cases they are taken to the river, but in others they are taken and emptied on to the land.

12,736. If some general regulation was laid down I suppose the boxes could all be removed with benefit to the land and to the inhabitants?—Yes.

12,737. Have you found the boxes to be a nuisance?—No; I think it is the best arrangement in these petties. You have the place very clean. When a box is washed out all the place is clean. It is not like having a cesspool which you can never have perfectly clean. In a box you can partially deodorize it by scattering a few ashes on the top of the fæcal matter, and when you clear out the box and wash it out it will be perfectly clean for a time.

12,738. (*Chairman.*) Have you seen the earth closet which has been invented?—No; but I have no doubt it is a very excellent thing, and that it would be better if it could be adopted in preference to a watercloset. These are a great nuisance here because the drains are very imperfect and bad.

12,739. Does the local board remove ashes from houses?—They do upon certain conditions. I do not know what the conditions are, but they will remove them upon certain conditions.

The witness withdrew.

Mr. Charles Chambers (Todmorden) examined.

Mr. C. Chambers.

12,740. (*Chairman.*) In what business are you engaged?—I am a cotton spinner.

12,741. Where are your works?—About 150 yards from this place.

12,742. On the bank of the river?—Close adjoining.

12,743. What number of workmen do you employ?—About 200.

12,744. How long have the works been established?—40 years.

12,745. What horse power do you use?—About 50-horse power.

12,746. What weight of coal do you burn in a week?—About 24 tons.

12,747. What do you do with the ashes?—I throw them into the river, and always have done for 40 years.

12,748. Have you any privy accommodation upon your premises?—Yes.

12,749. Does the refuse go into the river?—It used to go into the river, but the local board, two years ago, arranged to take it away at certain charges. Since then we have made various applications to them, but we have never been able to get it done. The cart, horse, and man have been away. We take it away ourselves: but the local board made an arrangement to take it away at certain charges, and they have not done it; we do it ourselves.

12,750. Are you a member of the local board?—I have been.

12,751. Have you any land of your own?—Not in the valley.

12,752. I mean that you could cultivate by applying sewage to it?—No.

12,753. Would it be expensive to you if you were told that you should not do as you had done before, but that you must get rid of the refuse in some other way?—I should be willing to submit to a cost of that sort if it was made a general law. I think it is proper that all persons should be put under one regulation.

12,754. Do the floods in the river interfere with or injure your mill?—Yes. During the last 30 years I have lost the whole value of my property by floods flooding the basement and the machinery, which might have been cured if there had been some central controlling power to have spent perhaps 400*l.* in regulating the river, keeping it within its channel, and lowering its bed. I believe that the trustees of the Todmorden Road have lost more money than would have sufficed for building once for all the entire side walls which they have only imperfectly put there again and again for their own protection.

12,755. Are the floods worse now than they were when you first knew the river?—I think not. There is a larger area of ground covered with buildings, and very great injury is done to the people in consequence; but for the last 40 years we have always been flooded. This is the first time that we have escaped for 40 years, and our escape has been due to the river wall having kept up this time. It has broken down from time to time, but fortunately for us this time it is so far perfect as to keep the house out of danger; but I know how to sympathize with my neighbours.

12,756. Do you believe that the damage done to property, not to speak of the loss of life, which has been very great, must be measured by tens of thousands of pounds?—I have no doubt that an outlay equivalent to the money value of the damage caused by every flood would entirely cure the mischief. I mean that within an area of three miles of this place the money required to repair the damage for four miles down here would be sufficient to keep the river entirely within its limits, and prevent us from receiving any injury whatever and suffering so severely as we do.

12,757. (*Mr. Harrison.*) You would like to see some authority whose duty it should be to prevent ashes and other solids being thrown into the river, and to look after the bed of the river to see that it was kept at a proper depth, and that the banks were properly secured?—Yes, I should like to see that done.

12,758. How would you propose to raise money to carry out the requisite works?—By a general taxation in the district.

12,759. Within what limits should you confine that in the case of Todmorden?—I do not know why it should not be taken out of the county rates. I do not like very narrow areas. I think that we all live for one another. We did it in this way in the case of the cattle plague, and I do not see why there should be any exception.

12,760. (*Chairman.*) Did you contribute any part of the rates to pay compensation on account of the cattle plague?—I believe about 1½*d.* was put on to meet the compensations; but we did not have a single cow die in this neighbourhood.

12,761. You contributed a portion of your rates to those who had suffered more severely?—Yes, we did. There are such a number of proprietors on the river, and to each individual of them belongs a natural right, I suppose, but if one proprietor on the river is perfectly prepared to put his property in order and provide the security necessary for our protection, perhaps his selfish neighbour below will not do the same, and if he leaves 10 yards of wall in want of repair, the whole mischief may be done.

12,762. No willingness on the part of an individual, nor any amount of expenditure he may go to, will avail, if, as you have said, some selfish individual will neither take part in the cost, nor do any of the necessary work?—That is it. I know that Messrs. Fielden, of Waterside, have a considerable portion of fencing along this road, and there is no division between the road and the river, except the fence; and Messrs. Fielden, of Waterside, have I believe rebuilt their wall frequently, and made it stronger, so as to keep the water within the river; but there are the trustees of the turnpike road, who have another length of river wall, and the rumour is that they do not hold themselves bound to maintain the river wall, so that it is left in an imperfect condition filled up with loose rubble, stones, and loose dirt put on at the top to make a sort of loose wall, the consequence is that we have been flooded half a score times; it has done me about 500*l.* worth of damage in one flood.

12,763. (*Mr. Harrison.*) Did you hear what Mr. Sutcliffe stated as to the diminution of the power of his water-wheel from seven to five pairs of stones?—Yes.

12,764. Is that the case with other water-wheels here?—I have no doubt at all that the mill goits are filled up with lighter debris, that we throw into the river; but there is a heavy material that we have nothing to do with, ours is the most innocent. The ashes that are put in are very little above the specific gravity of water, except the clinkers, which go to the bottom, and there are very few of those. A great quantity of our stuff, if the river walls were good, would go down by the river. The mischief that is done to people owning watermills is from emptying foundations of cottage houses, and throwing in large boulders. Any man who builds a cottage wheels all the foundation materials into the river; the mills do not; they have been walled since I was a boy.

12,765. Is there much dyeing done in Todmorden?—None, except what we do.

12,766. What dyes do you use?—Nothing but indigo.

12,767. Do you pass the refuse from the indigo into the stream?—We do as our neighbours do; we throw all sorts of muck into the river that we can.

17,768. Would you be willing to keep your dye refuse out of the river?—Yes, if you made everybody else do the same. I think we all ought to be compelled to do it.

12,769. Can you keep it out?—Yes, at an expense, and if we cannot, there are people in the world who will do it for us.

12,770. Have you anything further to add?—Yes. I stated before that I was not flooded at all, but my neighbours' dwelling houses were flooded as usual as deep as before; all their cellars were under water. The road for about half a mile above us is rather in a curve. The whole of the surface water is drained from the road into the river, and all the gullyholes are open between the river and the road. The drainage between the cottage houses goes across the road also, and the flood here has been entirely due to those openings in the river banks. The system of drainage through the streets would have taken that water away, but the water has been backed up through the gullyholes, and the houses have been flooded, not by any great and sudden overflow, but by what the slightest amount of science might have prevented.

12,771. You mean perhaps that they should have taken the sewer down to a lower fall, so that the water would not have reached up to the places that were flooded?—Yes; but the cottages are drained across the road, and the road is drained, and the gullyholes are all open and untrapped, so that there is no protection against the water coming out of the gullyholes that drain the ordinary surface of the roads.

The witness withdrew.

Mr. Thomas Edward Hamerton (Todmorden) examined.

12,772. (*Chairman.*) What business do you carry on?—I was a solicitor; but I have retired from business now.

42,773. How long have you known Todmorden?—Upwards of 40 years.

12,774. I suppose the population has largely increased since you first recollect it?—Very greatly indeed.

12,775. Has the mill power increased?—Very much; they are building larger mills.

12,776. Can you remember the river during the whole of that period?—A little. I did not pay very great attention to it.

12,777. Are there not injurious floods here occasionally?—Very injurious and very distressing floods.

12,778. Have there been any lawsuits between owners of mills, in consequence of the state of the river at any time, as to water rights?—Yes; there have been frequent disputes as to water rights. As to floodings, about 10 years ago there was a severe flood and an action was brought by one of the inhabitants, who was injured, against the trustees of the Todmorden Road, to recover damages against them; it was tried in the County Court here. The case was argued, and it was decided on that occasion that the trustees were not liable, therefore it was decided against the plaintiff.

12,779. (*Mr. Harrison.*) Was the damage done proved to have been caused by the washing down of any part of the Todmorden Road?—It was from the washing down of the embankment. There is a particular part of the road towards Burnley, where the trustees of the road had made an improvement, and the cost was so great that they became alarmed and discontinued it; and the portion of the embankment above that, is continually liable to be thrown down by the pressure of the water.

12,780. Is there anything further that you wish to add?—I do not know that there is, except this, that the recent flood has been caused by the breaking down of the embankment, and if the river embankments were made firm and sound, and the river was made of equal width, so that the pressure would be equal, I think it would then carry away all the wrack that is put into it at present. The river opposite to my house is a great deal narrower than it is down below, and in consequence when the water gets down below it spreads out, and the silt falls there, and that causes the river above to rise; now I daresay the river is a foot higher than it was two or three years ago, the height keeps advancing, and in the recent flood, notwithstanding all the water that flowed out of the river through the breakage in the embankment, the river overflowed the bank opposite to my house, which it never did to that extent before. That shows that the water in the river, and the bed of it, are raised a foot higher, and that causes the water to overflow the bank. If the river had been made of a proper width, the flow of the water would have carried away the whole of the wrack.

12,781. Do you think it is advisable to place the river under the control of some governing body?—I do.

12,782. Whose duty it should be to keep the bed of the river in proper order, and to see that the banks were properly kept up?—Yes, I think it would be an excellent thing to do that.

12,783. Do you also agree that the district to be benefited by such a proceeding, or the whole county, should be made responsible for the expenditure?—I think the whole county; the matter should be a public thing.

TODMORDEN.

Mr. T. E. Hamerton.

19 Nov. 1866.

J. Fielden, Esq.

12,784. (*Chairman.*) You think that the rivers belong to the county, and the county ought to maintain them, not the manufacturers?—Yes.

12,785. As the manufacturers are rated the heaviest they would necessarily have to pay the largest amount?—Yes, they would.

The witness withdrew.

JOSHUA FIELDEN, Esq. (Todmorden), examined.

12,786. (*Chairman.*) Are you a member of a firm carrying on business here?—Yes; I am a member of the firm of Fielden Brothers.

12,787. Are you cotton spinners?—Yes, and manufacturers.

12,788. How long have your works been established in the Valley of Todmorden?—I cannot say.

12,789. Were they established by your father or grandfather?—By my grandfather, who came down into the vale from the hills in about 1783.

12,790. You are I believe some of the old manufacturers in the country?—Yes, certainly as cotton spinners.

12,791. Have you more than one mill here?—Yes, we have many mills in this valley, we have five mills on this river, and we have several mills on the tributaries to the river up in the hills.

12,792. What number of hands do you employ?—About 2,000 when all the machinery is at work; it is not all at work now.

12,793. Have you any idea what weight of coal you burn per annum at your several mills, or what horse power you employ?—At all the mills we employ from 500 to 600-horse power, and we burn many thousands of tons of coal per annum, perhaps 700 tons a month, or more than that.

12,794. Is it brought to you by railway?—A considerable quantity is got in the valley, up towards Bacup; we buy it there.

12,795. What does the coal cost you a ton here?—Engine coal varies according to the place it comes from, some of it will cost from 6*s.* to 7*s.* a ton, and other coal will cost from 7*s.* to 8*s.* a ton.

12,796. What do you do with the ashes that are made at your mills?—We put the whole of them into the river, and always have done so, at least ever since I can remember, and I have no doubt it was so before.

12,797. Are any of your mills situated immediately on the banks of the river?—Yes, nearly all of them.

12,798. Have they at any time suffered from flooding?—The largest mill at Waterside has.

12,799. Did it suffer last week?—Very little, but previously it did. We have never suffered to the extent that other persons have. All that we have suffered has been from the water getting in two or three inches deep, and leaving a deposit of mud on the floor; we have never had goods destroyed.

12,800. Not so much as Mr. Charles Chambers?—Nothing like it.

12,801. Has the bed of the river risen since you first remember it?—There are two rivers; one is the Walsden water, and the other is the Burnley river, they join in the town. The bed of the Walsden river has not risen, I believe, and during this flood, although I believe the water was as high as I have ever seen it in this river, it did very little damage, because the bed has not risen; the walls kept the water in. The most disastrous flood that I remember in this valley was in 1851; I think the water then came over the wall, above the toll bar at the end of our works.

12,802. Do you consider that you have acquired what is termed a prescriptive right to turn ashes into the river?—We believe so. I may mention that throughout this particular district the effects of a flood may result, not from the height of the water, but from a fence breaking down, and the water inundating certain portions of the district. In 1851 it was noticed that the water ran over the wall I have named. It broke down and the district was inundated. On Friday I noticed that it went over that wall, but the wall did not break, and consequently we were not inundated. If the wall had broken, the flood would have destroyed a good deal of property—not houses, but it would have inundated them and caused a great amount of misery. The bed of the river in the Burnley valley certainly has risen. People who have lately died have told me that they could remember the time when they had seen a cart and horse driven under the bridge at the higher lodge at the Centre Vale, but now I do not believe that a little child could go under.

12,803. Then it must have been raised there many feet?—Yes six or seven feet, and I believe that that has been owing to the diversion of the river made by the railway company when the railway was laid down from the Shunley valley. There is a chapel at a place called Patmos, and from that point the river took a straight course down to above Mr. Sutcliffe's mill at Stansfield Bridge. Now it comes into the Walsden River at a sharp angle almost at right angles, and the length of the river is increased. The bed of the Burnley River has been raised, and the effect has been that the floods have been more disastrous than before the rivers were altered.

12,804. (*Mr. Harrison.*) You would argue that there should be some control in order to prevent works being executed that should cause such a deposit?—Decidedly.

12,805. (*Chairman.*) Do you consider that your firm has a prescriptive right to pass solid refuse and ashes into the river?—We think so, and for this reason. There was a trial about it, and an attempt was made by some millowners down the valley to prevent the ashes going in.

12,806. When did the trial take place?—Some years ago. An association tried the question; the party proved that he had been in the habit of putting in ashes for 20 years, and the judge ruled that he had acquired a right.

12,807. I believe it was stated at Halifax, that an association binding each other not to pass solid refuse into the river was formed there, and that they endeavoured to induce the manufacturers in Todmorden to adopt the same regulations, but you declined?—I do not remember that circumstance, but we rather gathered that they were determined to make us.

12,808. If you were compelled to provide some means for disposing of your ashes, I suppose it would cost your firm a considerable sum per annum?—We should have to cart the ashes away to some place.

12,809. You would have to do as the Swansea copper smelters do, make a spoil bank?—Yes, we should have to put them on to the land, or sell them, and it would of course be more expensive; now we wheel them into the river, then we should have to pay for carting them away.

12,810. You would be at no greater disadvantage than many scores of manufacturers who formerly put their ashes into the river in such places as Wakefield, Bradford, and Halifax, but who now, by an arrangement of their own, do not do so, for they have them carted away at a cost sometimes of 1*s.* a load?—We should be like everybody else, if we had to conform.

12,811. Is there any chance of your sending the ashes away for ballast?—I think not, because there are so many in this place; I do not think the railway could take them all.

12,812. (*Mr. Harrison.*) At the present time the solid refuse passes down the river, it receives a check at each weir, and is passed on or removed by the millowner, eventually towards Wakefield; it is then dredged out by the Aire and Calder Canal Company?—Yes, it passes away somewhere, and I think when the river becomes wider and less forcible in its career, it will deposit, that is the effect in all rivers.

12,813. (*Chairman.*) The fact that the bed of your river here is not raised very rapidly cannot be taken as a proof that the bed of the river is not raised in some parts of its course where its flow is slackened, and the fall is very much less?—No.

12,814. (*Mr. Harrison.*) You would admit I presume that the passing of your ashes into the river here does cause expense to individual millowners below, and to the Aire and Calder Canal Company who have to dredge them out?—I think it must do so, but I do not think that the ashes will cause so much

obstruction as the solid matter. The ashes are very light, and they will go away almost to sea in a flood; they go at once, but the solid matter, as Mr. Chambers said, which is taken out from foundations of houses will no doubt be deposited sooner. And then there is an immense amount of rubbish that comes down from the hills with every flood, because the waters gather on these moor lands, and rushing down the narrow rivulets bring all the rubbish in these channels down into the river, and that is the deposit which I think is most objected to.

12,815. (*Chairman.*) You know the character of the mountains and rivulets in this neighbourhood, would it be very expensive to make refuse traps by putting strong rubble walls across the ravines so as to check the rolling down of grit and stones to the valley below?—It would be expensive, but I think it might be done.

12,816. (*Mr. Harrison.*) Are you aware that it has been done on the river Aire?—It has been done here. I have done it. There was a culvert just above this place, which was constantly getting filled up. The railway company and the trustees of the turnpike road agreed with me to repair the culvert, and to make a wreck-dam, as it is called, to prevent the culvert being filled with the rubbish. The wreck-dam is emptied out after the flood has passed away.

12,817. If the river was to be put under a Conservancy Board, I suppose it would form part of the general arrangements that they should look after that matter?—Yes.

12,818. Have you considered the desirability of a Conservancy Board for rivers situated as these are, where so many interests are concerned, and so many persons are liable to suffer by neglect?—I think there ought to be some authority to deal with these matters.

12,819. Suppose, for example, that the manufacturers here have the power to elect a Conservancy Board, which should have the general regulation of the entire drainage area of the rivers with a power of appeal to some government authority?—I have not thought of the matter yet in that light.

12,820. Should the expense be provided for out of the county rate?—I think such a scheme would pay us here well, if we could so work it as to cure the evil; individuals cannot do it.

12,821. Large as your firm is you could not, I presume, put your own property into such a condition as to be absolutely secure, if other persons had power to do something contrary to your interests, which they might think was for their own advantage?—No, we could not, and for this reason: If we were to put the river here on both sides into repair, and persons above us left the banks insecure, in a time of flood the waters would break through and come down upon us as they do now.

12,822. Although the common law is very powerful, you could not recover damages from a person who neglected his property?—No.

12,823. And I assume that you do not consider it very satisfactory that one neighbour should be compelled to take proceedings against another?—No.

12,824. You would not like to be sued by some of your neighbours down the river for polluting it with ashes?—No.

12,825. You would rather be ruled by some general law, and you would prefer that all persons throughout the country should be treated as one and the same?—Yes.

12,826. You would be willing to be put under some general system which had received careful consideration?—Yes.

12,827. (*Mr. Harrison.*) Do you employ any water power?—Yes.

12,828. Have you found it injured at all by the the condition of the river?—No, not permanently; in one place the water-wheel gets stopped in a time of flood.

12,829. What arrangements have you made in the way of privy accommodation for your hands?—The soil is all collected in boxes and is put on to a midden, we then cart it on to our own land.

12,830. You do not allow it to pass into the stream?—Never; we always keep it out because it answers our purpose for the land.

12,831. Do you dye at all?—No; I believe that Mr. Chambers has the only dyeworks here, except one other person who does a little.

12,832. Is there any refuse from your manufactories that passes into the river?—Nothing except ashes.

12,833. (*Chairman.*) Every other form of waste is collected and disposed of?—Yes.

12,834. The only difficulty you would have would be in finding a place on which to store the ashes?—Yes.

12,835. Otherwise it would be merely the cost of carting them away?—Yes.

12,836. (*Mr. Harrison.*) You have stated that you get some coal from a colliery in this neigbourhood?—Yes.

12,837. According to the geological map before me, the coal field does not appear to extend within many miles of Todmorden?—There is a large coal field all about Todmorden up the Burnley and Bacup valleys.

12,838. Is there anything further that you wish to add?—I believe that the inhabitants of this district are willing to do whatever they can to prevent such disasters as have occurred. The local board some time ago had this subject brought to their notice, and they certainly were inclined to deal with it, but the board had no powers. The clerk advised them that they could not recover the rates levied for such a purpose.

12,839. You are a member of the local board?—Yes.

12,840. Did you borrow any money under the Government grant of 1863?—No.

12,841. You maintained your own poor at that time?—Yes.

12,842. Have you received since that time a sum of money from the Central Relief Committee?—Yes; the district of Todmorden received about 5,000*l.*

12,843. You did not borrow any money for any public purpose?—No.

The witness withdrew.

JOHN FIELDEN, Esq., (Todmorden), examined.

12,844. (*Chairman.*) You are chairman of the local board?—Yes.

12,845. Do you corroborate the evidence given by your brother?—Generally I do.

12,846. Do you think it necessary that some better power should be exercised over the rivers of this country?—Yes.

12,847. To prevent their obstruction by solids and general pollution?—I think so. I think it would be very desirable if it could be carried out.

12,848. Do you think that if certain regulations were put in force, your firm would be put to any considerable annual expense to get rid of the ashes?—Yes, but I suppose we should get over that. I do not know whether the question of the coal pits has been mentioned. The pollution generally commences there, I think.

12,849. At the coal mines I suppose they pass the water into the river?—Yes.

12,850. It is ochrey?—Yes.

12,851. Is there any dyeing or washing with that water, or do you wash your warps?—No, we size them.

12,852. Are there any bleach works here?—No.

12,853. Is water used to any extent for washing cotton?—No.

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12,854. There is not much liability to injury from the ochrey character of the water?—No, but the water is so much damaged by the refuse that comes out of the coal pits that we cannot use it for the boilers at our works. We have therefore made reservoirs on the tops of the hills, and we collect water from the moors and use that instead of the river water.

12,855. Do you think that coal miners should be compelled to provide a place of deposit for the foul refuse which they pump out of their pits?—Certainly.

12,856. And that there should be one law for all?—Yes.

12,857. (*Mr. Harrison.*) Have you known of any attempt being made to deposit that ochrey matter?—No, I have not heard of any expense being incurred for that purpose. We are anxious to get coal from the neighbourhood if we can, and perhaps some general rate, or some commission, which should have power to take the necessary sum from the county rate, in order to supervise this district, and carry out any improvements that might be deemed advisable would be better than individual action.

12,858. What is the population of the district?—I think it is 14,000.

12,859. Is any system of drainage carried out in Todmorden?—A very bad one, I believe.

12,860. You have the old highway drains?—No; there is a sewer carried down a certain district called York Street, but it is not a good one. We intend to call in a proper person—an engineer—to give us an estimate.

12,861. Have you any land adjoining the town that would be suitable for irrigation?—Scarcely so. About two miles down I think we might get a place, but here it is rather difficult; any land that we have here we prize very highly; I mean any level land.

12,862. Does the health of the inhabitants of Todmorden come under your notice as chairman of the local board?—We do not take cognizance of that, there are no reports sent in to us, as a board, about the health of the inhabitants.

12,863. Do you know what the health of the town is as compared with other towns?—I think the mortality is not greater than in other towns.

12,864. Do you know what the death rate is?—I do not.

12,865. Do you agree with the chairman as to the propriety of taxing the county for inspection and improvement of the rivers?—Yes. I do not see that there is any better plan.

12,866. Would you have any special taxation in the case of improvements made in towns like Todmorden and Halifax?—I think the funds would come perhaps most fairly out of the county rate.

12,867. If a river was pitched and walls built on each side, so as to confine the water for the special improvement of a town, do you think the whole county would be properly taxed for that?—I think where there is a boundary taxation might be confined within that boundary; perhaps such as a borough, or the jurisdiction of local boards, but I have not sufficiently considered that question.

12,868. (*Chairman.*) That would be breaking every area up into sections; a river is co-extensive not only with one county but with several, it passes in and out, irrespective either of township, parish, or county boundaries?—Yes.

12,869. Any damage done to that river is more or less felt throughout the whole area, and any improvements affected in it would be more or less beneficial throughout the whole area?—Yes, but this is a question that one cannot answer very easily off-hand, it requires a good deal of consideration.

12,870. Supposing the legislature was of opinion that the manufacturers caused all the mischief and determined that they should pay all the costs?—I should oppose that certainly. The manufacturers do not cause all the injury without conferring some benefit; they bring occupation at the same time.

The witness withdrew.

Mr. P. Ormerod.

Mr. Peter Ormerod (Todmorden) examined.

12,871. (*Chairman.*) What business are you engaged in?—I am a cotton spinner and manufacturer. We have one mill in the town, and another in Walsden, mile and a half from here.

12,872. How many hands do you employ?—600 or 700 at the two mills.

12,873. Are the mills situated near the river?—Yes, one is. Walsden Mill is over the river.

12,874. What weight of coal do you burn in a year? We burn nearly 100 tons a week.

12,875. What becomes of your ashes?—In Walsden we put them into the river, at the other place people want them generally. We take them on to some vacant land, and people take them away, the railway company and others.

12,876. Would it be a very great hardship to you if you were told that you should not put the ashes into the river again?—If it were made a general thing we should of course give in to it—it would certainly be attended with some expense.

12,877. But you think you ought to meet that do you not?—Yes, in some shape, if it was made a general thing.

12,878. Have you suffered at all from the recent flood?—Not this time.

12,879. Have you suffered from any flood before?—Yes, we did in 1859 at Walsden.

12,880. Do you know whether any millowners down the stream have suffered from the last flood?—Not in Walsden. When we were injured in Walsden it was by some timber coming down and getting across the arch under our mill; the timber came from the railway and other places, and the water brought down a great quantity of timber.

12,881. Did you take any proceedings against the railway company?—No.

12,882. I suppose you would rather suffer some damage than go to law?—We had no very great damage to suffer, but we do not like to go to law; there was other timber as well as the railway company's, trees that had been sent down the river from places higher up, and which had slipped down out of the hill sides.

12,883. Did you hear the evidence given by Mr. Chambers and by Messrs. John and Joshua Fielden?—Yes.

12,884. Do you agree with the evidence which has been given generally with regard to the causes of the pollution of the river and the proposed remedies?—Yes, generally I do.

12,885. Do you think it is necessary that there should be some restrictions enforced in order to prevent the pollution of rivers?—I believe it would be for the benefit of the country.

12,886. What do you do with the night-soil?—It is carted away.

12,887. Does any of it go into the river?—Yes, some of it does.

12,888. Is it difficult to keep it out?—I do not think it would be very difficult, but the principal bulk of it is carted away.

12,889. Do you think you could cart it all away, if that was made the general rule?—Yes.

12,890. (*Mr. Harrison.*) Did you hear what was stated about taxing the county?—Yes.

12,891. Is it not the case that a great part of the West Riding consists of moorland?—Yes.

12,892. I presume that in manufacturing districts the largest ratepayers in the West Riding would be found ?—Unquestionably.

12,893. So that any taxation would fall by comparison lightly upon the agricultural districts ?—Yes. I understand that there is a great extent of moorland in the northern part of the West Riding where there is very little manufacturing.

The witness withdrew.

Mr. JOSIAH LORD (Todmorden) examined.

Mr. J. Lord.

12,894. (*Chairman.*) You have been a machine-maker ?—Yes.

12,895. You are now out of business ?—Yes.

12,896. Where were your workshops situated ?—We commenced up in Walsden, the workshops are now in Canal Street, but I formerly worked for Messrs. Fielden Brothers.

12,897. How long can you recollect the valley of Todmorden ?—I can recollect it very well for the last 45 or probably 50 years.

12,898. Do you think that the river bed has been at all filled up since the commencement of that period ?—Yes; I could not agree with Mr. Joshua Fielden in his statement; I hope he will excuse me. The river is materially filled up, and I have been an observer of it on this account, that I used to be fond of fishing.

12,899. Will you name any of the bridges which have been filled up since you recollect ?—The Grinning Dog Bridge used to be the old highway to Rochdale, but that is, I believe, diverted, and the bed there is, I should say, 12 or 18 inches higher than it was formerly. I went to Messrs. Fielden in 1822.

12,900. What other bridge is there ?—Gandy Bridge, that is on the Burnley Road. I used to live there.

12,901. On what river is it ?—I forget whether it is the Cal or the Der. When they are united they are called the Calder. I know that the Burnley valley is three feet higher at the very least than it was since I first recollect it.

12,902. Did you ever see, since you have resided in Todmorden, anybody throw any solid refuse into this river ?—Yes, many hundreds of tons. I do not agree with Mr. Chambers. I think that all of it ought to be kept out.

12,903. What sort of solid matter have you seen thrown in ?—Ashes, from great boulders to ashes out of the mill, as Mr. Chambers says.

12,904. Did not Mr. Chambers say that he would be quite content that everything should be kept out ?—He did, but he said that ashes did not do so much harm as people think that they do.

12,905. Then there is a difference of opinion between you ?—Exactly.

12,906. But Mr. Chambers said, "I will keep out "all my refuse, if everybody else is made to do the "same" ?—Unless we are all compelled to keep those things out, I think that one has as much right to put them in as another.

12,907. And I suppose that you would not like to be told by either of these upstart people down below that they would make you keep them out ?—I should not much mind it.

12,908. But you would fight against it, would you not ?—I should not myself, perhaps some of these large millowners would. A great amount of matter comes off the hill sides and is washed down into the river during flood time.

12,909. Do you not think that that could be kept out by traps ?—It could be kept out in a better but more expensive way. You might compel people to build a wall on each side of the river, and that would prevent a great amount coming down into the river.

12,910. I suppose that there would be no cost but the labour; there are large quantities of stone there ?—There are large quantities of stone there. There is another thing which has raised the bed of the river more than formerly. Formerly they used to throw the great boulders out of the watercourse excavations, and mend the turnpike road with them; they do not do so now, because they find that that stone does not wear.

12,911. And if they broke it up would it not get down into the river as sand ?—Certainly some part of it would, but that is lighter.

12,912. It would alter its character from boulders to sand ?—Yes.

12,913. Did you ever see any road scrapings poured into the river ?—To a very great extent; they used to pour them all into the river, but now they use them for foundries—for moulding.

12,914. That material answers for that purpose ?—Yes, it is the best thing which they can get. In fact they fetch hundreds of tons down from this road on account of the qualtity of the stone from which it is made.

12,915. What stone is it made from ?—It is from Bearnshaw Tower. It is a very fine grit, called Galliard in this neighbourhood. It is not like the Gannister at Sheffield.

12,916. Did you hear the evidence of Messrs. Fielden ?—Yes, I heard the evidence of both of them.

12,917. As to the amount of pollution which goes into the river ?—Yes; not only is water turned in from the coal-pits, but there is the refuse from the coal-pits, and it comes down here and helps to fill up the brook.

12,918. I suppose that if they have a watercourse near enough they let their bank top wash away ?—Yes, and they get rid of it as soon as they can.

12,919. Do you think that that ought to be stopped ?—Yes.

12,920. Both foul water and every form of solid refuse ?—Yes. If they cannot make use of the solid refuse in any other way, let them take off the sod and cover it over again, and let the land produce two crops of grass, where it now only produces one. It will be an expense certainly, but it will improve the land. There is another cause of the watercourse being filled up, namely, the alterations which the railway company has made. That matter has been spoken to before by other persons.

12,921. If there had been a proper authority to look after the whole river, I assume that that authority would have looked after the railway company ?—Yes

12,922. And it might have been as powerful as the railway company —Yes.

12,923. And have kept them in order ?—Yes, the material all stops at that point called Patmos, the state of which is a very good criterion of the change in the river. The water used to be very deep there, in fact we could catch fish there very nearly at any time we liked, but the water now has very nearly gone away. The petties opposite Patmos or Cobden are over the river.

12,924. Is there anything further which you wish to add ?—The main course of the Crow Carr Ings being flooded at the present time is the bursting of what we call Major Clough, that is a small rivulet which runs at right angles into the river. It is filled up; the millowners have put in some cloughs, and have blocked up the water, and it has washed the embankment away, and it has gone down to the basin at the Crow Carr Ings. That is the reason of that district being flooded so much as it is, in fact it was flooded yesterday morning a second time.

12,925. Any general authority which had power to regulate the river would see that it was not tampered with ?—Yes, and I think that they would see to it in another way; they would turn the stream in at another angle, so that the water would have a greater fall.

12,926. That would do as much good as is done now, and not quite so much harm ?—It would do more good and no harm.

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12,927. (*Mr. Harrison.*) Did you use engine power at your works?—Yes.

12,928. How many boilers had you at work?—When I was in the firm we had two.

12,929. Did you take any steps to prevent smoke when you worked those boilers?—Not then; they have done so since, and I am glad to say that they have accomplished the object.

12,930. How have they accomplished the object?—By Jukes's furnace; it used to be the worst chimney in the neighbourhood, and now it is the best.

12,931. How long has Jukes's furnace been applied?—From two to three months, and it is a perfect cure; you will see no smoke come up at all.

12,932. (*Chairman.*) Do any of the chimnies in this valley smoke at any time?—Yes, very much; the smoke is so thick that you could cut it with a knife.

12,933. If smoke can be prevented by the means which you say have been adopted, do you think that it would be a very great hardship if every person was told that he must work his engines without creating smoke?—My opinion is that it is a benefit and not a loss.

12,934. These people seem to have too much money and so they wash some of it up the chimney?—Yes, to injure other people.

12,935. Is there anything else which you desire to state?—No, except that I wish you would compel all persons to keep refuse out of the watercourse, and to keep the coals in the coal-hole or consume the smoke.

The witness withdrew.

Mr. T. Priestley.

Mr. Thomas Priestley (Todmorden) examined.

12,936. (*Chairman.*) What business do you carry on?—I am a wholesale and retail draper.

12,937. Where are your premises situated?—In Cheapside, Todmorden.

12,938. Are your premises situated near the river?—Yes, just across the road.

12,939. Does the flooding of the river ever injure you, or interfere with you?—It has done so.

12,940. Are you a member of the local board?—No.

12,941. How long do you remember these streams in Todmorden?—18 years; I came here in November 1848.

12,942. Do you think that they have been raised in their beds since you recollect them, by the pouring in of solid refuse?—I think that there has been a gradual rising.

12,943. By solids being thrown in?—Yes.

12,944. Have you suffered any injury in your own business by the flooding of the river?—Yes.

12,945. When?—On the last big flood but one I must have suffered 100*l.* damage. The last big flood was on the 6th September 1861, and the flood to which I allude was in August 1859.

12,946. Do you think that the flooding could have been prevented if the river had been in a proper condition?—I think that if the walls had been strong enough and high enough the flooding would not have occurred.

12,947. Then if some authority had had the power to make the walls strong enough, and high enough, you need not have lost your 100*l.*?—Just so.

12,948. Have you seen any solid refuse at any time thrown into the river?—Yes, hundreds of cartloads—stuff from the road, and everything; in fact the watercourse here is a common receptacle for everything.

12,949. Have you privies or waterclosets on your premises?—Yes.

12,950. Do they drain into the river?—No, they are emptied by hand, and the contents are taken on to the fields.

12,951. Have you heard the evidence which has been previously given?—Yes.

12,952. Do you agree with it generally?—Perfectly so.

12,953. (*Mr. Harrison.*) Have you privies or waterclosets?—They are privies.

12,954. Detached from the house?—Yes.

12,955. What means do you take to deodorize the fæcal matter?—When the box is full it is emptied, and the contents are taken on to the fields.

12,956. Do you use ashes with them?—Occasionally. I have used chloride of lime. I have sprinkled it over.

12,957. Do you use the house ashes?—No.

12,958. Do you find the privy at all a nuisance to your house?—I do not know that we do. There are other dwellings which are nearer than ours, which perhaps may be a little inconvenienced, but I do not know.

12,959. You do not find it any inconvenience yourself?—No.

12,960. How far is it from your house?—Perhaps 10 or 15 yards.

12,961. (*Chairman.*) Is there anything further which you would wish to add?—I do not know that there is. I entirely concur with the remark which Mr. Fielden has made, namely, that I wish that you would take a walk round and see the misery and desolation which has been occasioned by the last flood.

The witness withdrew.

Mr. E. Lord.

Mr. Edward Lord (Todmorden) examined.

12,962. (*Chairman.*) Are you a brother of Mr. Lord who has given evidence?—Yes.

12,963. Did you hear his evidence?—A portion of it.

12,964. Are you in business now?—Yes.

12,965. What amount of coal do you consume in a year?—About 1,500 to 1,800 tons a year.

12,966. What becomes of your ashes?—We have carried them away chiefly on to our own premises, and have raised the low ground about our own premises with them.

12,967. Have you put any in the river?—Never.

12,968. Are you not near enough to the river to do so?—No; in fact we could not put our ashes into the river because we have no right of road to the river.

12,969. If you had been on the river I suppose that you would have let them go there the same as your neighbours?—Most decidedly.

12,970. Have you ever seen any foundation refuse carted into the river?—Certainly.

12,971. A load or two?—Many hundred loads; there is no question of it.

12,972. Do you think that it is necessary for the good government of the river that there should be some new regulations with regard to passing in solids and keeping the banks and walls in order?—I do not attach the importance to it which some other persons do.

12,973. Have you seen the ill effect of the floods of the last week?—Yes, and have felt it.

12,974. To what extent?—I should think from 150*l.* to 200*l.*

12,975. Do you think that it could have been prevented?—Yes, I could have prevented it myself with 10*l.* if I had known beforehand that it was coming.

12,976. Do you think that with this knowledge you could protect yourself now from any future injury?—Yes, so far as the watercourse is concerned, unless a greater flood than this one came. If the bank of the river on the Langfield side had been six inches higher between the houses opposite Mrs. Lord's and Major Gurden's, we should not have had a flooding at all of the land in Langfield.

12,977. You think that that arrangement would have kept the flood off?—I am certain of it, because the flooding has been made simply by the running of the water over the bank and into the field, and the only drain for taking it off is so small that it could only take a very small portion of the water which came over.

12,978. Do you think that the bed of the river has been gradually raised by refuse coming down from the mountains as well as by that which is thrown in?—Yes, by what comes down from the mountains; and I say that the debris thrown into this river is altogether insignificant and has very little to do with the rising of the river bed.

12,979. (*Mr. Harrison.*) You mean in this immediate neighbourhood?—Yes.

12,980. (*Chairman.*) Do you think that it would be practicable to prevent refuse coming down from the mountains into the lower valley?—No.

12,981. Do you not think that rubble walls and cross dams in those mountain rivulets would act as traps and would catch the solids as they rolled down?—I think that they would to some extent, but that they would want more attention than they are worth.

12,982. Do you think that it is more costly to keep that refuse where it is, rather than take it out of the river when it has got in?—No; but my impression is that the river should be made so as to clear out itself.

12,983. Have you no feeling for your neighbours down in the valley below?—Yes.

12,984. Whatever you have suffered they have suffered also, and they have suffered more than you have?—If the same remedy was applied below as that which should be applied here to protect this district it would answer equally well; it only wants carrying forward.

12,985. Lower down to the sea?—That is all.

12,986. Do you not think that it is necessary and cheaper to keep the solids out of the river?—I do not see how you can do it. I think that the remedy is worse than the disease.

12,987. Do you mean keeping out the ashes?—I attach no importance to putting in the ashes, it is so trivial a matter; it is only like a pinch of snuff.

12,988. Then you mean a remedy as regards refuse from the mountain sides?—Yes, that is what I am alluding to. If the river was made sufficiently narrow, and if the foundations of the walls were put in so that the water could never wash the bottom of them, and if the banks were raised and made sufficiently strong, the water would wash its own way.

12,989. (*Mr. Harrison.*) Who do you propose should do that?—I should think that it ought to be a national thing, and that the whole of the country ought to combine and make all rivers which are subject to these things right.

12,990. And keep up the banks?—Yes.

12,991. That would be rather an expensive operation?—I believe that there has been more damage done in this very flood than the interest of the money that would be required for the outlay.

12,992. (*Chairman.*) You refer to what the manufacturers on the river areas have suffered in the last week?—Yes.

12,993. Besides the number of lives which have been lost?—No lives have been lost in this neighbourhood that I am aware of.

12,994. But in a great many of the towns below they have suffered severely in loss of life?—Yes.

12,995. (*Mr. Harrison.*) Have you applied Jukes's apparatus to the boilers?—Yes.

12,996. And with success?—Yes.

12,997. Have you done anything besides applying this patent apparatus?—No; so far as smoke preventing is concerned we use simply Jukes's stove.

12,998. Do you think that there would be any hardship in preventing all people from making smoke?—No; I believe that it would be a benefit to them.

12,999. Do you believe that by that, or by other means, smoke might be prevented?—Yes, I have no doubt of it.

13,000. It would be a great advantage, and would tend to the comfort and the health of the inhabitants of all these towns, if smoke were prevented?—Yes.

The witness withdrew.

Mr. Frederick Rodley (Todmorden) examined.

Mr. F. Rodley.

13,001. (*Chairman.*) What are you?—Surveyor and inspector of nuisances to the local board.

13,002. How long have you been surveyor to the board?—Nearly three years.

13,003. Have you charge of the streets and roads; the scavenging?—The turnpike road is managed by the trustees.

13,004. What length of streets and highways have you under your charge?—We have only about two miles repaired by the local board. The streets are nearly all private streets, repaired by the owners.

13,005. If you scrape your roads, what do you do with the refuse; do you pass it into the river?—No.

13,006. Have you ever thrown in any refuse from the roads?—No, not since I have been here.

13,007. Have you carried out regulations for preventing soil from privies going in?—In some instances.

13,008. But some of it goes in yet?—Yes.

13,009. Have you served people with notices not to do it?—No; it is mostly in the out districts that that is done.

13,010. Have any sewers been made since you have been surveyor to the board?—Yes; only to a small extent; a few sewers in our own roads, but not connected with any system of drainage.

13,011. The board have begun to talk of a system of drainage for the whole place, have they not?—They have been talking of it ever since I have been here.

13,012. But do you think that they are talking of it now more seriously?—We only go slowly in Todmorden.

13,013. Have you any rain gauge here?—Only what Mr. Stansfield has.

13,014. What effect has this flood had upon any part of the town and property, so far as you know?—About 300 dwelling houses have been flooded.

13,015. Have the inhabitants been seriously injured?—Yes; they could not go out of their houses for 24 hours or 48 hours; they had the water 3 feet 6 inches deep, in some instances, in their living rooms.

13,016. Who will be at the cost of cleaning it out?—That will have to be done at the expense of the tenants.

13,017. Was there much sediment—sand and rubbish?—Yes, mud; but no heavy material.

13,018. Do you think that that flood could have been kept out if there had been proper arrangements on the banks?—No.

13,019. You think that the houses are too low?—Yes; they are not fit to live in.

13,020. Before persons can build any houses here they have now to lay a plan before the local board?—Yes.

13,021. And would the local board prevent houses being built in places of that sort?—Yes, we do so now.

13,022. You would consider that that land should be raised before being built upon?—Yes; the local board came 10 years too late as regards Todmorden.

13,023. Who are the landlords who own those houses, are they the owners of the mills?—No, they are small owners.

13,024. Some of them I suppose have suffered themselves?—Just so.

13,025. Have they at all complained to you of the flooding?—No, they never make any complaints of the flooding.

13,026. They think that it is of no use?—Yes; I should recommend the board to buy those houses, or to take them in some way, and to fill the place up.

13,027. Do you think that the bed of the river has been raised, since you have known it, by refuse coming down?—In 1864 I made some observations, and ascertained the depth of the debris in this part of the river. When the railway company diverted this portion, they paved the bottom; it is inverted there, and I ascertained that the minimum depth of accumulated material was about 3 feet 6. I tried it in four or five

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different places, and they are in about the same condition now, only that I believe that there will be a considerable deposit from the flood of last Friday.

13,028. Some people say that floods wash the river out. I suppose that you find that that is not so?—No.

13,029. That if the refuse is washed away in one place it is accumulated in another?—Yes, the flood has deposited many tons of stuff upon the Burnley turnpike road.

13,030. The Turnpike Trust will have to remove it?—Yes.

13,031. If that wall had been strong enough, would that have been prevented?—No, the bridges are not strong and big enough. At Gaudy Bridge several things were brought down by the flood, which could not be removed at the time.

13,032. Do you think that some general regulation is wanted for the river for the purpose of keeping the banks in order, and of keeping the bridge ways open? Yes.

13,033. Do you think that it would be a very costly thing to reduce the bed of the river so as to open out the bridge ways?—I think that the bed of the river will constantly rise.

13,034. Except it is kept down?—Yes.

13,035. Do you know Bacup?—A little, not much.

13,036. Have you been there lately?—Yes.

13,037. There is a local board in Bacup?—Yes.

13,038. And they have taken some of the Government money for their sewerage and local improvements?—Yes.

13,039. Have you seen in the papers that they have not suffered very much, and that they attribute that result to their having deepened and cleansed the river, by the money which they obtained from Government?—I have not.

13,040. (*Mr. Harrison.*) Can you give us the death rate in this parish?—No.

13,041. In the new buildings which are erected, do you make any provision as to the ash pits and privies?—Yes.

13,042. What provision do you make?—We require a privy to be provided for every house, or every two houses at most, and each house to have 100 square feet of space.

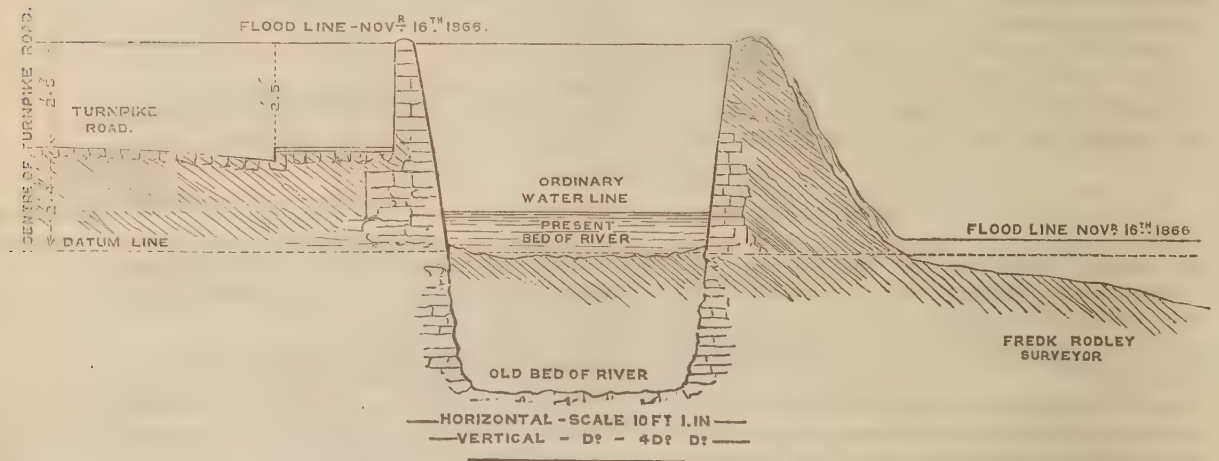
13,043. Do you make any regulation as to the distance at which the privy shall be from the house?—We allow five feet as a clear space between the house and the privy.

13,044. (*Chairman*). You have byelaws?—Yes.

13,045. Can you put those byelaws in?—Yes, they are framed upon the byelaws issued in London from the Local Government Office.

The witness withdrew.

The witness subsequently prepared and forwarded to the Commissioners a Transverse Section of the river Calder, at Burnley Road, Todmorden, taken after the flood of November 16th, 1866:—



Mr. J. B. Bamford.

Mr. James Byrom Bamford (Todmorden) examined.

13,046. (*Chairman.*) What are you?—A surveyor.

13,047. Resident in Todmorden?—Yes.

13,048. In general practice?—In general practice.

13,049. How long have you resided in Todmorden?—12 years.

13,050. In your occupation have you made any levels, or cross sections, having reference to the river?—I have not.

13,051. Have you made any observations with regard to the condition of the river, whether it is rising in its bed, or not?—I think that it is, but I have not levelled it. I have a few statistics which I have kept as to floods.

13,052. Will you put before the Commissioners any remarks or statistics which you have to offer as to flooding?—On the 26th October 1855 there was a flood.

13,053. What height did it rise?—I could not get out of the house at Patmos. Our house was 4 inches deep, but the houses below were 3 or 4 feet deep.

13,054. Did the poor people suffer very much in consequence?—Yes.

13,055. How many houses should you think were flooded?—I should think 40 or 50 at that particular place.

13,056. When was the next flood?—On the 10th August 1856; that was deeper than the former one which I have mentioned.

13,057. How much did it flood your house then?—7 inches.

13,058. And how much did it flood the property below?—3 inches more than before.

13,059. How many houses did it flood then?—About 50. Gandy Bridge burst at that time, and the river wall was washed down opposite the "Shoulder of Mutton" Inn, Toad Carr, and a part of a house at Gauxholme was washed down by the giving way of the arch there.

13,060. Were any lives lost?—No.

13,061. Do you consider that the arches over the river are too small for these excessive floods?—Yes.

13,062. And you think that they should either be deepened or widened?—Yes, I think that they should be deepened.

13,063. When was the next flood?—On the 7th December 1856; that was not very deep; it was only two inches deep in my house, and the river wall was washed away opposite the "Shoulder of Mutton" at Toad Carr.

13,064. Do you think that a stronger wall would have stood?—Yes, it has done so below.

13,065. How much do you think that a wall would have cost them?—I cannot tell.

13,066. Do you know about what money damage there was from that flood?—No, I cannot tell that.

13,067. But there was a considerable damage?—No doubt of it.

13,068. Besides inconvenience?—Yes.

13,069. When was the next flood?—On the 15th August 1857. It was then 9 inches deep in my house.

13,070. That was higher than any of the others?—Yes.

13,071. And of course all the houses were flooded so much higher again?—Yes.

13,072. What was that from?—From the bursting of Pudsey dam and the watercourse wall.

13,073. And the bridges were inadequate again?—Yes.

13,074. When was the next flood?—On the 7th August 1859. That was not from the Burnley valley, but the water was 2 feet 5½ inches deep in the "Golden Lion" Inn.

13,075. And of course it was over all these roads?—Yes.

13,076. Did it damage much property?—Yes; Mr. Chambers and Mr. Priestly both sustained heavy loss. Messrs. Ormerod's mill in Walsden was flooded by the arches lifting the shed floor. The river wall opposite the "White Lion" Inn was washed down, and all Waterloo was flooded.

13,077. How many houses were flooded there?—There was a flood all the way down here. 300 or 400 houses were flooded.

13,078. There was a flood all the way down here, 300 or 400 houses were flooded.

13,079. All of which would suffer more or less?—Yes.

13,080. I suppose that the flooding of these basements would leave the houses miserably damp all the winter?—Yes. The floods are generally in August, and it is May next year before the houses become anything like fit to live in. York Street cellars were flooded on the occasion to which I have just referred, the water was six and seven feet deep in the cellar livings. Mr. Hammerton's cellar was flooded. Hebden Bridge, Mytholmroyd and Bacup were all flooded by that particular flood and generally injury was done to them.

13,081. Have you anything further to state?—On the 6th December 1860 the flood was 12 inches deep in our house.

13,082. And it flooded other properties just the same?—Yes; we kept the water out of the house for a time by boards at the doors, but the pressure of the water outside forced itself up the floor in a number of miniature fountains. The river wall opposite Dr. Cockcroft's house broke down, and that caused the flood. On the 6th September 1861 the "Golden Lion" was 3 feet 8 inches deep in water.

13,083. That is the hotel in which we are stopping?—Yes. The wood yard was flooded.

13,084. And all the houses were affected?—Yes; a wall in a cottage was washed down and there were 5 feet 6 inches of water in the rooms.

13,384*a*. And all the basements were flooded?—Yes.

13,085. And a great deal of injury was done?—Yes. The waterside was flooded. Mr. Chambers' mill in Salford was many feet deep.

13,086. Mr. Chambers at that time suffered injury? Yes. All the Roomfield Lane cellars were flooded, Messrs. Fielden's wood bridges opposite the "White Lion" was damaged; Wadsworth Mill was nearly washed away, and the wall was burst there. Stoneswood Mill was five or six feet deep in water, Walsden Station was flooded, Ingham's Arch at Walsden burst.

13,087. It was blown up?—Yes, and the whole of the gardens on the top of it were swept away. There was no flood in the Burnley Valley at that time.

13,088. When was the next flood?—On the 7th May 1862 we were 12 inches deep with water in the kitchen. Gandy Bridge was lifted, it was blown up.

13,089. What was the next case?—On the 11th of June 1863 Gandy Bridge burst again.

13,090. And was the district flooded?—Yes, we were 12 inches deep in our house. On that day there was a local board meeting, and a deputation composed of Messrs. Shepherd, Mills, and others complained of Major Clough and asked the board to try to do something to prevent floods, and they partly promised.

13,091. What did the board say?—They said that they would see.

13,092. Have they seen yet?—They have not.

The witness withdrew.

Adjourned to Tuesday the 27th instant, at Keighley.

The following letter was forwarded to the Commissioners by Mr. Blackburn, of Brighouse, on the Calder:—

Brighouse, November 30, 1866.

GENTLEMEN,

As it seems somewhat probable you will not hold a sitting at this place, I have to ask you to excuse me writing to you upon the subject of your Commission.

I am the owner of three cotton mills here, driven by steam power, two on the banks of the Calder, whence I draw my necessary water supply. The damage done to me by the recent flood, and in the locality generally, is somewhat serious, and I believe much of it might have been prevented had proper precautionary measures been applied.

Since the flood I have had the river above my mills examined, and at one spot is found a sand bank nearly half way across, which is left bare when the river is low, while directly opposite it and in some other places the water is from six to 12 feet deep. This bank is the accumulation of refuse thrown into and left at the sides of the river by various parties, just because they find it a convenience.

It is clear enough that the existence of these banks is, partially at all events, the cause of the water overflowing in freshes.

I would therefore respectfully suggest that the bed of the river ought, in the first instance, to be cleared of everything it contains, so as to remove every obstruction to the flow of the water, and that inspectors should in future be appointed as "rivers inspectors," who should be under governmental direction, and in no way subject to local influence. These inspectors ought in many cases to have power to compel recent incroachments on rivers to be removed, for in places like this, where mills and trade premises are continually increasing, the becks and streams are frequently invaded for the purpose of obtaining a few yards of land; and to such an extent has this been done on the Clifton beck, that but for such contractions I believe the overflow would have been comparatively small (if any) to that which has just happened.

I am, &c.,

(Signed) THOS. BLACKBURN,
Cotton spinner, &c.,
Brighouse, Yorkshire.

To the Rivers Commissioners,
&c. &c. &c.

Keighley, Tuesday, 27th November 1866.

PRESENT:

ROBERT RAWLINSON, Esq., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, Esq. | Professor JOHN THOMAS WAY.

JOSEPH CRAVEN, Esq. (Keighley), examined.

KEIGHLEY.

J. Craven, Esq.

27 Nov. 1866.

13,093. (*Chairman.*) Are you chairman of the local board of this district?—I am, and I have been so from the first, for eleven or twelve years.

13,094. What is the population of Keighley?—Within the district extending a mile from this place I think at present it is about 20,000.

13,095. Has the population grown rapidly recently?—Yes.

13,096. Have manufactories been recently established here?—Yes.

13,097. Of what class?—The original trade was worsted spinning and manufacturing, now the iron trade has been introduced, machine making, machinery for worsted spinning, power looms, washing machines, manufacture of tools, and foundries for castings.

13,098. Do any of those manufactories use water largely for the purposes of their trade?—Some of them do to wash or for scouring the wool.

13,099. Are they situated on becks or tributaries of the river Aire?—Most of them are.

13,100. What becomes of the polluted water?—It runs into the Worth and then into the Aire.

13,101. What do they do with their ashes?—At present they cart them away somewhere. They used to put them into the beck; I daresay nearly every person at one time did so.

13,102. Do any of them do so now?—I believe not. The clerk to the board will tell you that proceedings which the board have taken against millowners and those who have manufactories on the banks of the river stopped them throwing their ashes in.

13,103. You indicted them for it as a local board?—Yes.

13,104. Have you an inspector of nuisances in Keighley?—Yes.

13,105. And a surveyor of highways?—Yes.

13,106. I suppose you instruct the inspector of nuisances to inform you if he finds any persons throwing in any rubbish or ashes?—Yes.

13,107. Have you any power as a local board to improve the streams by deepening the beds or walling the channels?—I am afraid not.

13,108. Have you carried out any system of sewerage in Keighley?—Yes.

13,109. What becomes of the sewage from the sewer's outlet?—Now we have constructed a main drain right through the town, and we are constructing another to take the sewage into the river Aire.

13,110. Are there any waterworks in Keighley?—Yes.

13,111. Belonging to the board?—Yes.

13,112. Where does the water come from?—It rises on the pastures on the west side of the town.

13,113. Have you impounding reservoirs?—Yes.

13,114. Do you know what your works have cost?—The present works have cost about 12,000*l.*

13,115. Was that raised by a loan?—It was borrowed under an Act of Parliament.

13,116. It was not borrowed altogether under the powers of the Local Government Act?—No, the waterworks belonged to a waterworks company, but now they belong to the local board; we purchased them.

13,117. Have you extended them?—We shall apply this session for an Act to extend the waterworks. The local board have not enlarged their works since they purchased them.

13,118. From which of the streams does the water come?—The gathering ground is on the west side of the town; we do not take any water out of any of the natural streams.

13,119. The water is obtained from that gathering ground?—Yes, from springs.

13,120. Have you carried out much house drainage in connexion with the sewerage works?—Yes, a pretty fair quantity.

13,121. Are there many waterclosets in the town?—Not so many.

13,122. This hotel and the better class of houses I suppose have waterclosets?—Yes, there are a few.

13,123. How do the owners of the mills dispose of their refuse?—They have not waterclosets, but they have privies, and the refuse is carted away.

13,124. It does not go into the river?—I think not.

13,125. Then the watercloset refuse will go into the Aire if you complete the sewerage works?—Yes, but the local board have discountenanced waterclosets.

13,126. What do they countenance?—Privies and ashpits.

13,127. Are any of those situated near to the cottages?—Some of them are getting down too near.

13,128. Are they placed underneath bedrooms in some instances?—I do not know that, but no doubt they are nearer than they ought to be.

13,129. Are there many unpaved streets in Keighley?—Yes; the town rose rather rapidly; people bought houses, and since the local board commenced, about 11 years since, we have done a great deal in paving and flagging many streets which had been entirely neglected before.

13,130. You can compel the owners of the land to pave the streets, can you not?—Yes.

13,131. The board have power to borrow money to enable them to do these things at a rate that shall not be oppressive to the present generation?—We have some money belonging to the gasworks, and we have generally lent that for paving purposes, and much has been paid back again.

13,132. Do the gasworks belong to you?—Yes, they do.

13,133. You possess the gasworks and the waterworks?—Yes, and the roads.

13,134. Do you know what amount of debt you have altogether as a local board?—A very small debt. The waterworks were sold to us for 17,000*l.* as a local board; the 6,000*l.* on the gasworks is all the debt there is on the local board.

13,135. Is the income sufficient to meet the interest of the money?—Yes.

13,136. Without a rate in aid?—We have a general rate which is for the roads and the lighting of the town.

13,137. (*Mr. Harrison.*) Has there been much injury done in Keighley by the floods?—Not a great deal I think.

13,138. As a local board, do you take any steps when new buildings are erected as to the position of the ashpits?—Yes, the plans have to be presented to the board and sanctioned before the houses are built.

13,139. Does the board stipulate that the privies shall be at a given distance from the house?—I do not know that exactly.

13,140. Do you take any steps to remedy the condition of those houses that have been built before?—We have not done much in that way; we have it in contemplation to widen and improve some of the streets, and where there is a nuisance we try to remedy it; we have been obliged to buy land and erect privies; a great many houses had none, and so we bought land and erected privies, and then apportioned the expense amongst those parties who used them.

13,141. Do you find that there is much improvement in the health of the people in those parts where the houses are built under your direction?—I do not think that there is much visible alteration in that respect; we have a pretty healthy place.

13,142. What is your death rate?—It is low. We have never had a single case of Asiatic cholera during all the time it has been in England.

13,143. (*Professor Way.*) Your intention, with regard to your future sewerage, is to discharge the sewage into the river?—Yes.

13,144. You have not contemplated any mode of dealing with it otherwise?—Yes; we have contemplated having some places for it to settle in.

13,145. But not to apply it to agriculture?—Yes; I mean a plan by which the sewage should be let to settle, and then the manure should be taken away.

13,146. Have you any knowledge of the methods which have been adopted for applying sewage to land in a liquid form?—No; we think that that matter must be considered at some time or other.

13,147. (*Mr. Harrison.*) How are these ashpits emptied from time to time. Does the local board take any steps to see that they are emptied?—They give notice to parties when they see that the ashpits want emptying, and the parties themselves empty them. I believe they have to pay somebody to take the ashes away; at one time farmers would fetch them.

13,148. Does the refuse from the ashpits find its way into the river or beck?—No; I think it generally gets on to the land.

13,149. The only sewage matter that finds its way into the beck or river is that discharged from the water-closets by your sewerage system?—Yes.

The witness withdrew.

Mr. Isaac Booth (Halifax) examined.

13,150. (*Chairman.*) Are you engineer to the local board of Keighley?—Yes.

13,151. Consulting engineer? — Yes, consulting as well as acting engineer.

13,152. Are you also engineer to the local board of Halifax?—No; but I act occasionally for them.

13,153. How long have you been resident in Keighley?—I am a native of Keighley, but I am not a resident at the present time, nor have I been since 1851, when I went to Halifax, and I have continued to live there.

13,154. How long do you remember Keighley?—30 years and more.

13,155. In what condition were the streams and tributaries to the river Aire when you first knew them as compared with what they are now?—The condition of North Beck particularly, some 30 years ago was very different from what it is now in respect both of purity of water and of the amount of solid refuse placed in the bed.

13,156. Has the bed of that beck been at all raised by solid refuse thrown into it?—It has risen very much within my own recollection; not less than 4 or 5 feet in vertical height.

13,157. What effect has that had on the adjoining land, is the valley a ravine?—Yes, it is; it has had this effect, that all the drains and the sewers emptying themselves into a portion of the North Beck, and some of those emptying themselves into the Worth, have actually become choked up.

13,158. The beck has choked the mouth of the sewers up?—Yes, in several cases the bed of the beck is up to the top of the sewers.

13,159. Is much of that refuse washed down by the floods from the mountains?—No doubt some portion of it comes from the natural operation of the floods; but the greater part of the evil is attributable to placing solid matter in the course of the beck.

13,160. What class of solid refuse has been put in within your knowledge?—Engine ashes (but I do not think it is done now), and foundation material.

13,161. And road scrapings?—Yes; I have seen them placed in the beck many times.

13,162. Where the highways have been adjacent?—Yes.

13,163. Has the beck altered its course by washing its banks away?—No, and for this reason, that its course through the town is circumscribed, by buildings erected on it, and also by the precipitous nature of its banks.

13,164. Has the beck been arched over in any parts of the town by persons for their own purposes?—There is one instance of that kind.

13,165. Is there sufficient waterway under that arch to let the floods pass?—Yes; I believe it has always been equal to discharge the flood water.

13,166. Has there been any injurious flooding in the town recently?—Yes, on the North Beck there is one foot bridge near to Cabbage which has been destroyed.

13,167. But there has been no very serious injury?—Not in the town I believe.

13,168. Did you design the present system of main sewers?—Yes; I did.

13,169. Have any of the outlets of the sewers been impeded by the bed of the river having been raised since you designed them?—No, the system itself is not yet completed. The proposed outlet of the main sewer was directed into the river there (*pointing to a plan*) below that weir. In connexion with this subject the question of dealing with the sewage matter incidentally came up, and negotiations were entered into with the view of erecting at this outlet works, either to filter the sewage, or let it settle, and let the liquid matter pass away.

13,170. Is that land there (*pointing to the plan*), ever underflood from the joint action of the two rivers?—I have seen all this (*pointing to the plan*) covered with water in times of flood, and this road (*pointing to the same*) rendered nearly impassable; that was many years ago, and I believe it has been so recently; but at that time this weir (*pointing to the same*) was in existence, and impeded the free action of the water in the course of the river, and sent the water over its banks. That weir has been taken down in conjunction with other works which have been executed by the Airedale Drainage Commissioners, and the water which formerly remained in the higher parts of the river now passes away without flooding the land here; but it goes down in a large volume, and the consequence is that the land below is flooded.

13,171. Has this new road (*pointing to the plan*) been made?—No, that was a projected road, and negociations were entered into, but they went off on a question of terms.

12,172. What is the sectional diameter of this sewer (*pointing to the plan*)?—4 feet.

13,173. Half of it is in the ground and half out?—Yes; in some places it is half in the ground and in other places entirely. At several points it is totaly buried, and in others there is a little embankment.

13,174. What is the estimate for the entire sewerage as laid out by you?—I think it is about 2,000*l.*

13,175. That would be merely for that outlet sewer?—Yes. It begins from the railway crossing where the new sewer constructed by the Duke of Devonshire is, and ends down at the outlet.

13,176. Where is the existing outlet?—The outlets for the sewage of the town are in various places. There are several, both into the North Beck and into the Worth, but there is a district here (*pointing to the plan*), called Eastwood Row, which has its outlet at exactly the place where the new sewer was designed to have its outlet. But the old drain was mainly an open ditch, and at this point (*pointing to the plan*) there were ponds erected to collect the solid matter, which has been taken out from time to time, and the refuse flowed out by the old drain and found its way down here (*explaining*).

13,177. Has this tributary, the Worth, any considerable rise upon the portion that we see upon this map?—Some.

13,178. I assume that it rises more rapidly than the main stream into which it goes?—Yes; the total

KEIGHLEY.

Mr. I. Booth.

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rise of the Worth from its junction with the Aire at Stock Bridge to its source, beyond a place called Ponden, on the western side of the boundary between Lancashire and Yorkshire, is 775 feet, and the total length of the stream is 9 miles 1 furlong and 5 chains. The configuration of the country almost suggests that the river Worth and the North Beck should form two separate questions for consideration, inasmuch as the river Worth, above its junction with the North Beck, passes through a district which may be called an agricultural district; there is no town upon it, although there are many mills. Upon the North Beck there is the town of Keighley, and a totally different state of things.

13,179. Do you know the dry weather flow of the river Worth at Keighley?—Not from actual gaugings; but it is tolerably low, and it is impeded by all the weirs upon it, which are in great numbers. Upon the river Worth, from its junction with the river Aire along its whole course, there are about 22 mills.

13,180. What kind of mills are they?—They are mills which are almost exclusively confined to the special business of the locality, worsted manufactories and spinning mills. There is here and there an exceptional case, but not of any moment.

13,181. Do those mills use the water, and more or less pollute it?—Many of them do use water power.

13,182. Do they use the water for washing more or less, and pollute it before passing it back into the stream?—Yes, it is polluted, no doubt, to the extent that it is used. But until the Worth gets down to its junction with the North Beck the amount of that pollution is not so very great, though much worse than I can remember it to have been formerly.

13,183. Do any of those mills use steam power pressure with their water power?—Nearly all of them.

13,184. What do they do with their ashes?—I cannot say exactly. Formerly they used to put their ashes into the river, and latterly upon the North Beck I have seen ashes deposited.

13,185. Have you seen ashes on the North Beck within the town of Keighley?—Yes.

13,186. But the North Beck has nothing like the extent of the Worth?—No, it has not. The North Beck is 2 miles and 7 furlongs in length from its junction with the Worth to a place called Slippery Ford, where the feeders branch out in three or four directions.

13,187. What fall has the North Beck?—The fall from the source of the North Beck to its outlet into the Worth is about 500 feet.

13,188. Have you any tabulated statement as to the mills that you can put in?—No, I have not; but I have the particulars here which I can give you. First as to the Worth: Upon the banks of that stream there are 18 mills between Stockbridge and Ponden, which is the highest point where there is a mill upon the stream.

13,189. What fall is there between those two points?—Between Ponden and Stockbridge there would be about 500 feet.

13,190. Which would be available between those points?—Yes. Besides these 18 mills on the Worth, there are some four others at some distance from the stream, but which drain into the stream, making 22 in all upon the Worth proper. One of the tributaries of that stream is called Sladen Beck; upon it there is one mill or two mills, I am not sure which. Then there is another tributary called Bridgehouse Beck, and there are 17 mills upon it or draining into it, so that in reality the river Worth, above its junction with North Beck, and its tributaries, receive the drainage of 40 mills.

13,191. I suppose you do not know either what power the mills have or what number of hands are employed?—No, I do not.

13,192. Are any of them new mills recently erected?—Yes, there is one or two, but they are mostly old mills. They have become enlarged as the requirements of trade have necessitated enlargement.

13,193. Do you consider that the whole of the stream is so occupied now by mills that any great addition in number is not probable, although enlargement may take place?—No, I do not think so. There is yet an unappropriated fall upon that stream to a considerable extent.

13,194. Upon which additional mills may be erected?—Yes, taking the water power from the Worth. Then the North Beck, from its junction at Keighley to Goose Eye, the highest point where any mill exists, has 13 mills upon it, and upon one of its tributaries, called Newsholme Beck, there are three mills.

13,195. When speaking of mills, I suppose in all cases you mean manufactories, and not corn mills?—Yes; there is one corn mill, but I have not made any distinction.

13,196. It may be as well to distinguish between corn mills and manufacturing mills. I assume that the corn mills are not so liable to pollute streams as manufacturing mills?—Just so; there are 12 manufacturing mills or manufacturing premises and 1 corn mill.

13,197. Are there any corn mills on the river Worth?—Yes; there are two small corn mills. On the Newsholme Beck, a tributary of the North Beck, there are three mills, one is a worsted mill, another is a bobbin mill, and the third is used for some special purpose, for making cotton bands.

13,198. None of those, I suppose, would materially pollute the stream?—No; the bobbin mill would not. There is a change going on there just now; I believe they will make the bobbin mill into a worsted manufacturing mill. There is another mill distant from the stream making a total of 17 upon it.

13,199. What is the number of mills that you have enumerated?—57, on both streams, large and small. Besides those there is a number of iron foundries, the number of which I cannot give you, in the town itself, and there are some which adjoin upon the North Beck particularly, but the others are situated in the town, and about half of them drain either into the North Beck or into the Worth.

13,200. Is any part of the North Beck or of the Worth, as they pass into or through the town, pitched in an invert?—I believe not.

13,201. Some of the streams, I believe, are arched over?—In one case the North Beck is covered over by a spindle manufactory, or a machine shop.

13,202. Do you know what opinion prevails here with regard to the ownership of the bed of the beck or stream, is it that the adjoining owner claims to the centre of the stream?—The custom here differs from that in other places, with the exception of the Aire, where the owner of the land on each side claims to the centre of the stream; in all other streams generally the whole bed belongs to the owner on one side.

13,203. The boundary of an estate in many instances, is defined by a fence on one side of the stream, leaving a strip of land between the line of the stream and the fence?—Yes.

13,204. Is it the law that a ditch always belongs to the field in which it is?—No; that does not prevail generally here. I have known some instances in this neighbourhood where the centre of the fence itself is the actual boundary. I have known other cases where 18 inches from the roots is the boundary, and where 36 and where 40 inches from the roots is the boundary.

13,205. In some places it is the law that a ditch belongs to the field in which it is?—Yes.

13,206. I suppose these becks in some instances follow that law; they are supposed to belong to one side or the other, where they form the boundary of one portion of an estate?—Yes; for instance, here (*pointing to the Ordnance map*) it is so.

13,207. As these streams are continually altering their course, does the boundary remain?—Yes; I imagine what happens is this: the actual boundary between two properties has been fixed to be one side of the stream, then the owner of the land on the opposite

side, in order to make his boundary more definite than before, has erected a fence on the edge of the stream; then in time the stream has altered its course, and so left those little strips of land between the fence and the edge of the stream.

13,208. (*Mr. Harrison.*) How is the ownership decided in case the stream encroaches upon the fence?—I have known several instances of that sort, where an encroachment has taken place, but the bank has been repaired at once.

13,209. And the boundary restored to its old limit?—Yes.

13,210. The stream has been confined to its old limit?—Not much attention has been given to that; where a fence has been knocked down by the stream, the owner has immediately repaired it, and restored his own boundary to its former condition; if he does not do so he loses his land.

13,211. (*Chairman.*) Can you give us any details as to the existing water supply, and what you propose doing for the future?—I can. The present water supply is derived mainly from springs, of which I have here the details.

13,212. What is the subsoil from which the supply is obtained?—This district is in the very heart of the millstone grit. Within the valley there is a very large depth of alluvial deposit, in the shape of gravel, but the subjacent rock is millstone grit, and that is found in the higher portions of the town. Quick sands also exist in the lower portions, and they have occasioned great trouble in the erection of works at times. The present waterworks consist of a reservoir at Calversike Hill, containing 1,550,000 gallons of water. I cannot give you the area or the greatest depth of the embankment. This (*pointing to the map*) is the reservoir which has been made.

13,213. It is a service reservoir, is it not?—Yes; there are several cisterns about the town into which particular springs have been collected from time to time. There is one called the Blind Lane cistern, which is just below this reservoir (*pointing to the map*). There are two cisterns on the other side of the town which are called the Park Wood cisterns; another at a place called Seed Hill; another reservoir near to Castle Mill for the purpose of collecting the water from this stream (*pointing to the same*) and filtering it and bringing it into the cistern at Seed Hill, and also for giving out a direct supply. There is another cistern in Highfield Lane in the north part of the town; and there is a further reservoir, the largest which has been made by the old waterworks company, called the Highfield reservoir. This reservoir (*pointing to the same*) I am proposing to make into a service reservoir for the intended scheme.

13,214. What elevation is that above the ordinary level of Keighley?—About 550 feet above the sea level, and it has at least 250 feet of fall to the centre of the town.

13,215. What number of springs were available to the old waterworks company, or what volume of water daily could they supply?—There has been no specific record kept of the flow of most of those springs, but it was found that they yielded upon one occasion on the 13th June 1856, 61,300 gallons in a day, and on the 6th August 15,360 gallons. There are other springs and streams, the water of which goes into these reservoirs, and the old company appropriated them by sufferance; they were not authorized by their Act; they yield a considerably larger quantity, so that in fact the total daily flow of the springs and streams collected by sufferance is, in winter, 100,260 gallons, and in summer 64,650 gallons; the authorized quantity of the one source is 36,448 gallons, and of the other 12,470 gallons, the mean of which is 24,455 gallons.

13,216. What right have the board to take the larger quantity of 100,260 gallons?—They have taken some of it by agreement, and the rest at will; in point of fact they use it by sufferance; the average flow would be 106,910 gallons a day.

13,217. Did the board know what volume of water they would obtain at the time they purchased these works?—I presume they did, but I do not know that of my own knowledge.

13,218. Do you know what the estimated income was at the time they purchased the works?—I do not.

13,219. What proposed works have you in contemplation to extend this supply?—The proposed works are here (*pointing them out on the map*).

13,220. (*Mr. Harrison.*) The present supply is about five gallons a day per head of the population?—Yes; the works for the increased supply consist of storage reservoirs at a place called Butler Clough, and Slippery Ford, and near to the village of Newsholme. The compensation reservoirs are to be one at Slippery Ford, and the other on the Newsholme stream. This portion of the scheme relating to the valley of the Worth (*pointing to the map*) has been abandoned for the present, the board considering that this (*pointing to the map*) would supply all the wants for the present population.

13,221. Those two (*pointing to the map*) are both abandoned, are they?—Yes.

13,222. What is the subsoil at this point (*pointing to the map*)?—Millstone grit with intervening shales; the ground is remarkably firm, although it varies.

13,223. Standing almost vertically?—Yes.

13,224. What volume of water do you propose to impound and make available under the proposed plans?—I am proposing to bring to the town 500,000 gallons per day, exclusively from the North Beck valley, but when the Newsholme scheme is carried out that will increase that volume to 750,000 gallons per day.

13,225. What compensation do you give for that volume?—The exact amount is not yet determined. We shall go to Parliament next session. I shall calculate the available rainfall of the district, and make proper deductions for evaporation and otherwise, and then bring as near as I can two-thirds of the available rainfall to the town, and give off one-third as compensation to the mill owners.

13,226. What is the rainfall here?—My gauges have been only in since March, but I think the maximum fall is something like 42 inches, and the minimum about 33 or 30 inches.

13,227. What is the acreage that you rely upon for the rainfall?—I have hardly arrived at that yet in consequence of the gaugings not being complete.

13,228. Are no gaugings kept in this district?—No; there has been one, but I find that it is not of a reliable character; a man collects the rainfall into a little pot, and measures it in a very rude way.

13,229. Have not the Canal Company kept any gaugings?—I believe not.

13,230. But the neighbouring towns of Bradford and Halifax keep gaugings?—Yes, at Halifax they do, which is on the southern slope of the hills; we get something like 40 inches.

13,231. What has been the fall during these last wet days which caused the flood?—I do not know, but I believe it to have been $2\frac{3}{4}$ inches in about 30 hours on Thursday and Friday, the 15th and 16th instant.

13,232. Have you ascertained that from gaugings?—Not from gaugings in this district; I have not got the register in.

13,233. What is the estimate for these proposed works?—The estimate, subject to some reservation as to contingencies, is something like 16,500*l.*; but I quite expect that the works will cost 20,000*l.* or 25,000*l.* for 750,000 gallons a day.

13,234. What will be the area of the new reservoir, of the larger one?—About 10 acres; that is the Slippery Ford reservoir.

13,235. What will be the greatest depth of the bank?—63 feet.

13,236. What will be the volume of water impounded?—About 7,000,000 cubic feet.

13,237. That would be about 46,000,000 of gallons?—Yes, or 7,000,000 of cubic feet.

13,238. There are two reservoirs here (*pointing to the map*)?—Yes; this (*pointing to the map*) is the second bank.

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13,239. The lower one has an area of 10 acres and the upper one about four acres, I believe?—Yes.

13,240. What is the greatest depth of the bank of the smaller one?—48 feet.

13,241. What is its cubical capacity?—About 14,330,000 gallons.

13,242. Are there any other points that you wish to speak to?—Thinking that it might be useful I have taken out the length of these streams with their fall. The river Worth, from its junction with the Aire to its source, is 9 miles 1 furlong and 5 chains in length.

13,243. Is that as the crow flies or measured along the sinuosities of the river?—Yes, measured along the sinuosities of the stream.

13,244. Having a certain number of mills upon it?—Yes, having 40 mills and having a fall of 775 feet, and a draining area of 14,100 statute acres. The North Beck with its tributary, the Newsholme Beck, measured along the sinuosities of the river, is three miles in length, and has a drainage area of 5,100 acres; the number of mills upon it are 17, giving a total drainage area of the river Worth and its trbutaries of 19,200 statute acres.

13,245. Is the area that you have given confined to the North Beck, or does it include the entire area of the two systems of streams?—Yes; it includes the entire area of the two systems of streams.

13,246. Is it not confined to the length you have given?—No, it is not. The drainage area of the Slippery Ford reservoir is 1,874 acres, of which 500 are already appropriated by the millowners' reservoir.

13,247. What is that reservoir called?—It is called the reservoir on Keighley Moor. I call it the mill owners' reservoir; it has not a distinct name.

13,248. The millowners send down a certain volume every day into the stream for their own purposes, I suppose?—Yes, they do. That reservoir has recently been leased by the millowners from the Duke of Devonshire, who, I believe, constructed it, and now it is proposed to appropriate altogether a drainage area of 2,136 acres for the new works, leaving 2,964 acres which we do not interfere with.

13,249. Are you to give compensation out of those 2,964 acres, or provide it out of the remaining 2,136 acres?—We must give it out of the 2,136 acres.

13,250. Do you know what volume of water you are likely to impound upon the 2,136 acres?—I cannot give you that now; the gaugings have only been in existence for a short time, and the weather has been, I believe, very wet, so that it is hardly fair to take the present gaugings.

13,251. Can you safely calculate upon 700,000 gallons a day, plus the compensation?—Yes.

13,252. Out of the storage which you have named to us?—Yes. There is other information which perhaps I may be allowed to give. The total area of the township and parish of Keighley is 10,132 acres 1 rood and 26 perches; the district in which the local board exercises its jurisdiction contains but 1,800 statute acres of that area, leaving 8,332 acres 1 rood and 26 perches as the area of another local board, called the township and parish of Keighley local government board.

13,253. By the proposed scheme is it intended to provide water for both the boards jointly, or for Keighley proper only?—Power is sought to be obtained to supply all these districts below the level of the works with water, together with portions of other districts situated within the parish of Bingley. I would add that the uncultivated ground in this district is about 2,300 acres.

13,254. In the larger area?—Yes, so that there are about 6,032 acres 1 rood and 26 perches of cultivated ground in the township and parish.

13,255. What is the separate population of the two places, and the entire population?—The population of Keighley proper, I understand, is about 20,000.

13,256. What is the outside population?—That is about 3,500.

13,257. Then you have a population of 23,500 to provide for?—Yes, and more than that, because we seek power to provide water to supply a portion of the Bingley district, which is a thickly inhabited part.

13,258. Would you say 30,000 in all?—Yes, about that. It is not very easy to ascertain the population of the towns here. According to the last census, notwithstanding the large increase in the town, the amount of the population has actually been at a standstill.

13,259. You are contemplating, if you take the population at 30,000, and the volume of water at 700,000 gallons, a supply of a little over 23 gallons per head for each person, for domestic and trade purposes?—Yes.

13,260. Independently of the volume that you will give in compensation?—Yes.

13,261. You stated that the bed of the river here had been raised 3 or 4 feet, and you also said you remember that in consequence of the execution of works above, and the removal of a weir, the river Aire below its junction with the Worth was more flooded than it used to be. Has the bed of the river Aire been raised below the junction of the Worth?—Yes; at one point considerable works have been executed by the owners of property to restrain the current within better limits.

13,262. Is that below the junction of the Worth?—Yes; and even there there is an immense accumulation of solid matter now, and the effect, as I said before, has been that the lands below the junction of the Worth down near to Castlefield are very much more flooded than they used to be (I mean compared with the extent to which they used to be flooded). I knew that from observations I have taken as to the extent of those floods.

13,263. Have you observed that there are greater floods arising from the same amount of rainfall?—Yes.

13,264. A flood from a certain amount of rainfall now floods the land below the junction of the Worth more than it used to do?—Yes, I have no doubt of it.

13,265. Does the area of the Worth lie upon the millstone grit?—Yes, entirely.

13,266. Is there any land below the junction of the Worth with the river Aire that would be suitable for the application of the sewage of Keighley?—Assuming that all land is suitable for the application of liquid sewage as manure, there is no doubt of the land referred to being available, only one important difficulty is that the outfall of the sewer is too low to allow of the sewage being so used without pumping.

13,267. There is a considerable fall in the valley of the Aire, is there not?—Yes.

13,268. So that you might soon bring the sewage to the surface?—Yes, by going further down the valley.

13,269. Is there any coal marked in any portion of the area?—Yes, but not in any portion of the drainage area of the Worth, there have been slight attempts made in different portions of the district, particularly above Oxenhope, and some coal workings are carried on there at the present time.

13,270. There are some old coal pits marked on this map, are they old shafts in the millstone grit or through the coal measures?—Through the coal measures in many instances; there is an old coal shaft also there (*pointing to the map*) the millstone grit contains a great number of coal bands.

13,271. Thin worthless bands?—Yes.

13,272. Are those coal pits in the millstone grit in those old thin beds?—They are in the millstone grit. Just at the very edge of the drainage area is the outcrop of the Halifax beds, the lowest in the series; but there is one singular feature in this district (*pointing to the map*) that under the hill forming the northern side of the valley of the Aire there is one of these coal bands which, unlike the others that are seldom more than 9 inches thick, is about 16 or 18 inches in thichness, and that bed has been worked from time to time with interruptions as long as I can remember, but the outcrop of the coal measures proper extends beyond the drainage area.

13,273. Only small thin bands belong to the millstone grit?—Yes.

13,274. (*Professor Way.*) Water for the district is

generally obtained from the millstone grit is it not?—Yes.

13,275. And is termed good soft water I believe?—It is remarkably pure good water.

13,276. Of course it forms the body of the two streams, the North Beck and the Worth?—Yes.

13,277. There is not any large population is there, except the mill population above Keighley?—Yes; there is a large population above Keighley.

13,278. Are there any towns?—Yes, there is the town of Howarth; it is not a large town, but it is a very old town.

13,279. In the absence of mill refuse, would the Worth have been your entire source for a supply of water;—No; except as a last resort, it is so far off; it is at too great a distance.

13,280. At the present time you catch the water in gathering grounds at the upper parts of the district?—Yes.

13,281. If those streams were restored to anything like a moderate state of purity would they be useful for general purposes, apart from drinking purposes?—Yes. I am quite clear about that, and supposing the streams were relieved from the polluted matter which finds its way into them, there is no doubt that the water would be available for other than drinking purposes.

13,282. Supposing you had arranged for a supply of pure water for domestic purposes from a distance, it would still be an advantage to Keighley that the water flowing through it by the North Beck should be of a purer character?—Yes; there is no question about it. The difference in the effect between a pure and an impure stream must be considerable under any circumstances. I can give you the lengths of the other tributaries. Bridgehouse Beck from its junction with the river Worth at Vale Mill to Oxenhope Mill is 1½ miles. The Moorhouse Beck branch of the stream, from Oxenhope Mill to its source at Bodkin Bridge, is 1 mile and 1 furlong. The Leeming water branch of the stream is 1 mile and 1 furlong in length; those are all within the drainage area.

13,283. (*Mr. Harrison.*) Have you examined the river Aire above the junction of the Worth of late years?—Yes, I have.

13,284. Have the works which have been carried out on that part of the river been beneficial to it?—No doubt the land immediately above Kilderwick always used to be flooded with a very small rainfall indeed; it was hardly capable of being profitably used for agricultural purposes, but when a part of those new works were completed things began to change immediately, and that land now is in a very good condition.

13,285. (*Chairman.*) Who were the engineers who constructed those works?—Messrs. Martin and Fenwick of Leeds.

13,286. (*Mr. Harrison.*) You think that the works have been beneficial to the land adjoining, but you believe that they have been injurious to the land below the junction of the Worth?—I am quite clear about that. I attributed the difference in the state of the river below Stockbridge to the fact of the water, which, under the old system, was impounded in the higher parts of the valley, finding its way down more rapidly.

13,287. It floods the land more, it brings down the débris more rapidly, and raises the bed of the river?—Yes; I do not mean that the bed of the river has been raised from that source, but the waters of the river have overflowed its banks more frequently, and to a greater extent than before.

13,288. You would, I suppose, argue from that, that works of that kind should be carried out throughout the whole length of the river?—I am of that opinion most strongly. I find that every day's experience confirms it.

13,289. That would lead to the necessity of placing a river like the Aire under some general control?—Yes; it would.

13,290. (*Chairman.*) You mean that works partially carried out may benefit the individuals carrying them out to the injury of their neighbours below them?—Exactly so.

13,291. I assume you also mean that the filling of any stream by any process, such as throwing in refuse of any kind, may injure the stream not only at that point, but for a considerable distance below, or as far as the floods can carry down the solids?—Yes; that is the actual state of things.

13,292. Has there been a great addition to the mill power upon the streams in this part of Yorkshire since you can remember?—Yes, there has been a very large increase in the power, almost every mill in the district since I can remember has been considerably enlarged, that enlargement carrying with it a corresponding increase in the power employed.

13,293. Is there a considerable amount of pollution passed from Keighley into the Aire?—Yes; some years ago there was a very great amount, but there is not quite so much now.

13,294. From dyewashing I mean, and wool scouring?—There are no dyeworks here of any moment, it would be principally from woolwashing.

The witness withdrew.

William Ferrand, Esq. (St. Ives) further examined.

13,295. (*Chairman.*) You reside near this place?—I reside at St. Ives, a mile from Bingley.

13,296. What distance is Bingley from Keighley? Four miles by the road.

13,297. I believe you wish to add something to the evidence you gave at Leeds?—Yes; first of all I wish to mention that we have had considerable damage done by the late flood, I mean my tenants and myself, on a stream called the Harden Beck.

13,298. Is that a tributary of the river Aire?—Yes; we believe that that damage has been considerably increased by the manner in which the flood water has been let out of the Bradford reservoirs. You will remember that when you were there you advised that a by-wash should be made to the Doe Park reservoir, but no by-wash has been made. I wish to point out to the Commission the system which has been pursued by the men who have the care of those reservoirs. When the reservoir has got full, I am speaking now of the Hewenden reservoir, the water of the overflow rushes rapidly down the by-wash, and it is usual to open the culvert, or to draw the clough, as it is called, and let down a large volume of water, besides that which is running down the by-wash. Some few years ago, they had a heavy flood, and Mr. Anderton, a millowner, who lives in the valley, a short distance below, was standing on the embankment of his mill-dam, and he had scarcely stepped off it before the water that was let out through the culvert came rushing down, swept the embankment of his mill-dam away, and he narrowly escaped with his life. The other day, when the recent flood was rolling along, I looked out of my window, and I saw the Harden Beck flowing over its banks, and washing over the land. A small bridge which I could usually see from my house was completely hidden by the water. In five minutes afterwards I went to the window and I found that the flood had ceased on the land and the bridge was quite perceptible. On examining the beck my impression was that in those five minutes the flood must have settled nearly a foot The consequence of this great volume of water being let out so suddenly is that it washes the embankments away on both sides of the stream; the late flood has done a considerable amount of damage. I am desirous therefore of pointing out to the Commission the system which now exists, because if the reservoirs in that valley were to be increased three-fold or four-fold, which they might be in carrying out this system of supplying water to towns, and if for all was adopted this plan of letting out the water suddenly through culverts, without pro-

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per by-washes to let it flow regularly down, we must have most serious damage done.

13,299. You are probably aware that a bill was prepared last session for the regulation of reservoirs?—Yes.

13,300. For their construction and management?—Yes.

13,301. It was carried through certain stages by the Government, but it was too late in the session to be passed?—I am aware of all the circumstances connected with that bill, but I think it is of the greatest importance that you should see the necessity for some stringent regulations being passed as to these reservoirs, such as I believe are not provided by the measure to which you have referred.

13,302. The evidence which you have now given will in due time come before Parliament. Your opinion at present is that the reservoirs have not sufficient by-wash room provided to allow the water to flow regularly down, and pass evenly away?—Decidedly.

13,303. And that the mischief is added to by opening the cloughs and drawing from the main body of the water at times when there may be a flood?—Exactly so. The overflow through the by-washes rushes down with great impetuosity, carrying away almost the whole quantity of rain water that has fallen at the top of the embankment, at the same time they draw the cloughs up suddenly for a considerable distance, and the volume that thus comes down increases the velocity of the stream below so greatly that the embankment is washed away, and the consequences are most serious.

13,304. If the managers of the reservoir were compelled in each case to provide sufficient by-wash room for the natural discharge of the surface water, they would then never be capable of discharging more than was due to the surface, and such as must necessarily come in the natural state?—That is what I mean.

13,305. You would suggest that Parliament should fix them with the responsibility of providing sufficient by-wash room to take safely away the natural fall of water upon the surface?—Yes.

13,306. Without drawing upon the reservoir at such a time?—Yes.

13,307. And so adding to the volume of the water passing down and destroying property to a great extent below?—Yes.

13,308. If you were to take proceedings against the parties now, you would have great difficulty in establishing your claim for compensation, as the matter would be complicated and your claim would be resisted?—Yes; evidence would be produced on both sides, and that is a kind of action that is better avoided.

13,309. You would prefer that Parliament should lay down certain rules for the management of these matters, so that the landholders should be protected? Yes, such measures as would afford greater security both to land and property.

13,310. Has there been any damage done to the banks of the river Aire and the land on either side by the recent great flood?—On my property damage of the most serious kind has been done.

13,311. To what extent have you suffered damage?—I should say that at one sweep I have had an acre of valuable pasture land washed away entirely.

13,312. Has anything like that occurred to your property from any previous flood?—There was a flood a few years ago, about 1838, when the volume of water which came down this valley was considerably larger than in the recent flood. I know it by measurements taken at houses in Bingley which were then flooded. I cannot at the moment state exactly what the volume was, but I have no hesitation in saying, from my full knowledge of that flood and of the recent one, that the damage done to my property has been ten times greater from this flood than the former one.

13,313. Although in the former flood you think the volume of water was greater?—I know it.

13,314. The recent flood has damaged your property to a greater extent than the greater flood in 1838?—Yes, to a far greater extent. I would account for it in this way—and it is the general opinion of the inhabitants of Bingley who have resided on the banks of the river for many years, and have watched the volocity of the Aire—that on this occasion the velocity of the river was increased to a most extraordinary extent, and it will be so whenever a flood takes place. It is the consequence of the river having been straightened between Skipton and Keighley; it is the consequence of carrying out the Airedale drainage system and cutting the river straight.

13,315. You think that the improvement which has been carried out under the Act of Parliament has tended injuriously to affect your property and the property of others near Bingley?—Yes, most seriously.

13,316. By increasing the velocity of the stream?—Yes, and to an extent that is quite extraordinary to look at. No one would believe it unless he had seen the river before the alterations were made. As soon as the first part of the alteration was completed, I had a strict watch kept on my property, and when the floods came they began to scour out the banks on both sides.

13,317. Do you not believe that the deepening and straightening of the river may have had the effect of benefiting the lands on either side?—Not, I believe, to anything like the extent that was expected.

13,318. But still, I presume, you do not doubt that the lands on either side may have derived some benefit?—I have no doubt of that so long as the flood is within certain limits. For example, they have no flooding, comparatively speaking, between Skipton and Steeton; but in a heavy flood their property is still flooded, although the water runs off with great rapidity. The water is now carried to this point (*pointing to the map*). This is the river Worth (*pointing to the same*), and this valley during the flood was one sheet of water for several days. I may mention that the chief ground upon which the Parliamentary Committee gave their assent to the straightening of the river Aire was the medical evidence that was produced. The witnesses stated that the flooding of the land in the neighbourhood of Skipton, Glusburn, and Kildwick had produced a large amount of typhus fever for many years. They have now, by straightening the river between Steeton Bridge and Stockbridge let the water down to this point just below Keighley, and from Stockbridge to Castlefield, a mile above the town of Bingley. The population here (*pointing to the map*) is four times greater than in the neighbourhood of Skipton, and if typhus fever was produced at Skipton, as stated by the witnesses, it must be produced at Bingley by the floods. You will perceive that Skipton is at the foot of a great range of hills, and there has been an immense quantity of agricultural land drainage carried on in Craven. Nature provided a security for land and property in this valley by all these sinuosities that you see on the map, which checked the rapidity of the river, and this bend (*pointing to the same*) has been a safeguard to the property below Stockbridge. If they cut that through I believe that a bridge over the river Aire could not stand such a flood as we had the other day.

13,319. Is there a bridge there (*pointing to the map*)?—Yes, a county bridge.

13,320. Do you think that will be carried away?—I have no doubt of it, and I believe the riding will have to pay 1,500*l.* if that bridge is washed down. Suppose they cut this through (*pointing to the map*), and a flood comes so much deeper down below Stockbridge, the valley of the Aire will be flooded between Bingley and Keighley. Keighley has a population of 20,000, and Bingley has a population of about 10,000. Suppose they cut this (*pointing to the map*), and let the water down to this point (*describing*), where the river goes through a narrow gorge to the town of Bingley, I have no doubt that the flooding will be increased to the extent of 3 or 4 feet.

13,321. In your opinion, the river should not be tampered with, or dealt with piecemeal?—You have

put a question of great importance, and I say that they had no business to tamper with this river; what they ought to have done was to clear out the bed of the river. Mr. Bateman, an engineer of eminence, was called to prove the necessity or utility of such a step, and was asked this question: "Do you believe that if "they had cleared out the bed of the river it would "have answered equally well towards draining the "valley?" and his answer was, "I have no doubt of "it." Not only this, but the consequence of pursuing the opposite course, viz., straightening the sides has been that the flooding at all times is far greater; in all probability the railway bridge near Apperly would not have been washed away if it had not been for the artificially-increased rapidity of the river. If they let the flood down to this point (*pointing to the map*), through the valley, they will contract the river and send it down to the villages in a far deeper volume and with far greater speed, and they will do an immense deal more damage.

13,322. You desire to call special attention to this case, so that, if any scheme for river improvement should be propounded, the question should be considered as a whole, and the special effect of what has been done here fully inquired into, so that no similar mistake should be made again?—Yes, exactly. I think it is of great importance, now that we have heard what has been the result of straightening this river, that such a step should never be taken again, unless under the authority and with the sanction of some Government inspector, who had inquired previously as to what the probable effects might be.

13,323. In your experience have you ever known of any solid obstructions being thrown into the river or its tributaries near Bingley?—There is a little stream that runs through the village of Harden, and I have noticed during the last two years that the inhabitants have made a practice, which they never did before, of throwing broken pots and all kinds of refuse into this stream; it is only about 4 feet broad, but the other day there was a gardener at work in a garden, and he cut down a large quantity of gooseberry bushes and other refuse, and he threw them into this stream. The consequence was that when the flood came, it washed all this refuse up against an archway, the water flowed back, and must have done between 40*l.* and 50*l.* worth of damage to some beautiful ground belonging to one of my tenants. Now I would suggest that all these streams should be kept perfectly clear from every kind of refuse, and that penalties should be inflicted upon persons who did damage to the property of others, by throwing anything into three streams.

13,324. When such a regulation as that had been established, how would you enforce the payment of the money?—I would have the payment of the penalties enforced by Act of Parliament.

13,325. How would you provide the expenses of the necessary supervision?—That is a question for Parliament to decide, but my own conviction is that every county should bear the burden of its own expenses.

13,326. Would you, as a riparian owner, complain of a rate, regulated by the strictest economy, being levied upon you to carry out the regulations necessary for the drainage of the whole valley of the Aire?—I should have the greatest pleasure in paying my quota, and perhaps I may be allowed to say that it is most gratifying to find that such a good feeling has been exhibited by all the gentlemen who have given evidence before you on this matter.

13,327. I suppose you do not anticipate that Parliament would subsidize Yorkshire in a matter of river purification, or river conservancy?—I do not think that the country generally should be called upon to do it. I think we are wealthy enough here, being all benefited by the trade of the district, to meet any money demands. I do not believe that any person would object to it.

13,328. Supposing that any special improvements were projected, such as those above Keighley, for the particular benefit of particular estates, do you think the money ought to be provided by a general rate, or that the landowners who desire to have the improvements made should exclusively pay for them?—I would make every landowner keep the bed of his own portion of the river perfectly clear.

13,329. Down to a stipulated level?—Yes, it should be kept at a proper level and at a proper depth.

13,330. As fixed and determined by some indifferent person?—Decidedly. I think there ought to be a Government officer employed.

13,331. Independently of local boards?—Yes; entirely independent of local boards.

13,332. Would you have a representative board to manage the conservancy of the river, or would you lodge the authority in some central Government department, as in France?—I should advise that there should be a Government department, and that all complaints should go through the Home Office.

13,333. Would you not contemplate any representation by persons elected from the district?—I doubt whether that would answer. I believe that you would have great difficulty in constituting a board sufficiently independent to act.

13,334. In this country, as you know, we assume that taxation is preceded by representation?—Yes; but I think you cannot have a stronger proof of the correctness of my view than the case of factory inspectors.

13,335. Do you think that they are doing their work advantageously to the public?—I do; and with great satisfaction to the employers and the employed. We scarcely ever have an instance in this neighbourhood of any manufacturer infringing the law; and although there was great doubt at first whether the scheme would answer, I believe it has answered thoroughly well.

13,336. And beneficially for the persons who were controlled?—No doubt of it. The magistrates have the carrying out of the law, and in every case, in these manufacturing districts, we have more magistrates engaged in trade than are connected with land.

13,337. You are of opinion that some machinery, not unlike that prescribed by the Factory Act, would be the best form of river conservancy?—Yes, as far as the inspectors go; but I should wish clauses to be inserted in the Act giving power to the police to lay informations.

13,338. If you bring in the county and borough police, I suppose you would bring in magisterial influence at the same time?—I believe that the magistrates, as a body, do their duty most fairly, and that their decisions are most impartial.

13,339. Do you mean the unpaid magistracy?—Yes. In corporations I should certainly have the borough magistrates, but where there was no corporation I should have the county magistrates.

13,340. Have you heard any discussion as to the propriety of having stipendiary magistrates?—I do not think that stipendiary magistrates would, generally speaking, be the proper persons.

13,341. Are they not found to be necessary for all boroughs?—Yes.

13,342. Do you think that the ordinary magistracy would act better for country districts?—I believe that the public generally have more confidence in the unpaid magistrates than in the stipendiary magistrates, more particularly as the stipendiary magistrates are paid officers as well as the police. The unpaid magistrates are vigilant and careful as to the performance by the police of their duties, and are very careful to perform their own duties properly.

13,343. Have you a seat on the bench here?—Yes.

13,344. Have you any difficulty at any time in forming a proper quorum?—Now and then we have, but very seldom.

13,345. Does it ever happen that there are too many on special occasions; for example, when there is any appointment to make?—We generally find that when there is a valuable appointment to be made at the

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General Quarter Sessions a large number of magistrates attend.

13,346. Whom you have never seen perhaps for a long time before?—They take great interest in the matter. I do not object to it at all. I think that magistrates and public officials take a deep interest in the election of a fit and proper person to fill an important office; the eyes of the public are upon them, and if they do not elect a proper person they lose caste as magistrates and as gentlemen.

13,347. Supposing that any special matters are entrusted to a large body of magistrates and that a select committee first does all the work and then brings it before the general board, does the general board necessarily confirm what has been done, or does not the general board sometimes upset the work of the select committee?—I generally find, in fact I may say that I always find, that the bench of magistrates select a number of their own brother magistrates who are well qualified to perform their duties, and in whom great confidence is placed, and it is very rare indeed that the decision of the committee is set aside by the general body of the magistrates. I scarcely ever knew an instance of a body of magistrates being appointed to inquire into any particular case when they did not most earnestly and zealously perform their duty.

13,348. I suppose you still think that the magistrates as a body would not constitute a proper board for the conservancy of the rivers?—I think that the magistrates would be too much interested in the matter, for you must remember that many of the magistrates are the owners of land on the rivers, and that many of them are largely engaged in trade. I would give every person a right to lay an information and prove a case. I would allow the police to be witnesses because they are a special body of men paid by the public and are constantly on the move; and the injuries are usually done in the night.

13,349. I believe that town councils usually have to carry out smoke clauses?—Yes.

13,350. Are they carried out in Leeds, Bradford, and Halifax?—In Leeds they have made great efforts, and they have been most successful. I understand that the authorities at Bradford are also going to carry out the clauses. I had a conversation with Mr. Salt, of Saltaire, the other day and he was pointing out to me the extraordinary success of his works there; and he also stated that it was an advantage and a saving to every manufacturer to burn his own smoke, that is to say, to burn the smoke with the view of producing heat.

13,351. In other words, to prevent smoke arising?—Yes. I may also mention this fact, that the town of Bingley is under the government of improvement commissioners; several of those commissioners are manufacturers. I have for a number of years suffered from most serious damage done to my woods by the smoke which comes from the chimneys in the neighbourhood. There is a clause in the local Act of Parliament for the improvement of Bingley requiring the smoke to be burned. Some years ago they put other clauses of the Act in force against some farmers who carried manure through the streets, and the farmers complained bitterly that penalties should be inflicted upon them for doing that, when, as they said, there was a clause in the Act compelling these improvement commissioners to burn their smoke, and they did not do it.

13,352. If the county magistrates had had jurisdiction in that case do you think there would have been a better chance of the smoke clauses being enforced?—I have no doubt of it.

13,353. If they could have appointed a smoke inspector selected from the police, and had instructed him to bring cases before the bench do you think the smoke nuisance would have been checked?—I have no doubt that it would; and I may be permitted perhaps to state what you I have no doubt know, that two-thirds of the smoke which is produced in these factories are caused by the neglect of the firemen, and the carelessness with which they throw on the coal. An instance occurred in my own neighbourhood lately of which I made a formal complaint. I find now that the great body of smoke has disappeared, and I can safely say now that very little injury is done.

13,354. (*Mr. Harrison.*) Do you not think that when there is an appointment to be made in the county such as the head of the police, or the governor of a gaol, the magistrates meet together, whether in a smaller or larger number, and take the testimonials which the candidates bring before them, carefully examine them, and exercise the best judgment that they can before they make the appointment?—The course adopted in the West Riding is this: we have a very large body of magistrates, and the testimonials in such cases are generally referred to a committee; the committee then report to the general bench, and my belief is that the magistrates, as a body, are greatly swayed by the decision of that committee. I do not say that there may not be some magistrates who have a personal feeling towards one candidate or another, but generally speaking an election to an office is decided by the names of most of the candidates being withdrawn, and three or four of the best of them being submitted to the bench for selection.

13,355. The object being to try and get the best man?—Yes, and I believe they do that. As to the other question, I believe that if the prevention of river pollution were left in the hands of the magistrates such a large number of the magistrates would be found to be identified with the trade of the riding that such a plan would give less satisfaction than if you had an inspector appointed by the Government.

13,356. You stated, I think, that you would leave those parts of rivers which passed through towns in the hands of the borough magistrates. You are aware that corporations and local boards carry out sewerage works and discharge the sewage frequently into rivers below the towns?—Yes; but I was alluding before more particularly to the refuse of various descriptions that is thrown into rivers.

13,357. Would you leave it in the hands of borough magistrates to remedy the mischiefs resulting from their own acts?—I believe that if you left the matter in the hands of the borough magistrates they would perform their duty; the eyes of the public are upon them, and they are certainly elected to a great extent by popular vote. I will take Leeds and Bradford as examples. I have no doubt that if you left the charge of rivers in the hands of the borough magistrates in those towns you would find that they would enforce the law; they might reduce the amount of the penalties, but they would strictly enforce the law; if not the public press of this country would compel them.

13,358. (*Professor Way.*) The general tendency of your evidence I think, is this, that a systematic management of rivers is a necessity?—I think that we have got to that state of things in this district, that unless something is done to stop the present state of things some frightful plague will break out, either in Yorkshire or in Lancashire, which will sweep off a large part of the population, and the time has come in my belief when the matter can be trifled with no longer. I do not believe there is a single gentleman connected with trade in this district who does not see the absolute necessity for some interference.

13,359. But each is powerless to move as an individual?—Decidedly, and for this reason: Suppose there are a dozen manufacturers on a stream, and 11 of them are anxious and willing to stop all these nuisances; but the 12th says, "I will not trouble myself about the matter, I have used this stream so long that I will not do anything." The consequence of that is, that the 11 men say, "It will be of no use our stopping it our neighbour will still go on and do as before, therefore, whatever we do will be no advantage, we shall only be put to considerable expense"?—I believe that the system can never be stopped by voluntary means.

13,360. (*Chairman.*) The one obstinate man says, "I have abused the stream so far, and I will continue to do it"?—Yes; I know instances; a man insists and will do it; he says that he has got his right, and his right he will maintain.

13,361. A large mill owner may say, "I have always thrown my ashes into the stream," and the question is, "Have you not been complained of by the people below?" "Yes," he says, "but we will not be stopped "by them; but supposing a law to prevent it is made "general, we will then stop it immediately"?—No doubt I think that many men who are now not inclined to yield would, if they saw that all men were restrained by law, say, it is as fair for one as for the other, and now we will stop. The truth is that people do not like to be interfered with by private individuals, whereas if there was a general law, I have no doubt that they would willingly succumb to it like loyal men.

13,362. (*Professor Way.*) And not only so, but they would be anxious to get such a law?—My belief is this, that not only land, but mills and property belonging to manufacturers, would be greatly increased in value, if the streams were kept reasonably pure. Nobody wishes to do anything to stop trade, but I believe that I am within the mark when I say that nine-tenths of the fouling of the rivers now of one kind and another might be stopped without injury to trade, and that the improvement in the condition of the water would be most valuable to the parties concerned. New works would then be erected, and an immense amount of capital would be introduced into trade, which would give increased employment to the population, and increased wealth to the neighbourhood.

13,363. (*Chairman.*) Has there been any increase in the agricultural value of land within the last 30 years to your knowledge?—Yes, very large in the immediate neighbourhood.

13,364. That, I suppose, has followed the increase of population?—No doubt of it.

13,365. With increased population you get an increased value given to land, especially near to towns?—Yes; I do not think that farms have increased in value in the last few years like land in the neighbourhood of towns for building purposes. The rates are heavy in manufacturing districts, and if there should happen to be a depression of trade, they spring up from 2*s.* to 4*s.* 6*d.* in the pound for poor's rates.

13,366. (*Professor Way.*) Has meadow land become more valuable?—In the last 30 years all land has increased in value, but not in the same proportion. You would not get a larger rental for a farm in this neighbourhood than in the Midland counties.

13,367. What is the value of land in this district?—It depends upon the locality. We have cold clay lands upon the high hills, which only produce small crops; it is very expensive to get tillage to them, and that is one reason why the sewage system would improve the value of the land in these manufacturing districts; the manure would be led from sewage tanks on to the hills at a moderate charge and it would pay the farmers.

13,368. I suppose that if judicious arrangements were made for the regulation of rivers all parties might be benefited?—No doubt of it, and the health of the neighbourhood would be greatly improved.

13,369. If you improve the health of the people and add to the wealth of the district you will of course have a fair return for any money that may be expended?—Yes, and I believe that people will pay their money cheerfully.

The witness withdrew.

Mr. William Burr (Keighley) examined.

13,370. (*Chairman.*) You are clerk to the Keighley board of health?—Yes.

13,371. What is your profession?—I am a solicitor.

13,372. How long have you known Keighley?—Intimately since the year 1847. I have known it from 1837.

13,373. Have you prepared any statistics as to the growth of the district within any given period?—I have not.

13,374. When did you put in force the Public Health Act?—In 1855.

13,375. Did you adopt that act after an investigation had taken place?—Yes.

13,376. By whom was the inquiry made?—By Mr. Ranger.

13,377. Was the act put in force under a provisional order?—Yes, and it was confirmed by Act of Parliament.

13,378. How many members do you elect to sit on the board?—21.

13,379. Do you remember what the population was at that time?—Perhaps about 15,000.

13,380. What is it now?—About 20,000, perhaps not so much.

13,381. Was there much opposition to the adoption of the Local Government Act?—No.

13,382. Have you made any purchases of property since the adoption of that Act for gasworks, waterworks, or markets?—We have bought property for gasworks and we have bought the waterworks, or we have contracted for the purchase of them. We have obtained a site for a town hall, but we have not gone on with it; the market we have not interfered with.

13,383. You have a local market?—Yes, but it is in the hands of the company who hold it as lessees under the Duke of Devonshire.

13,384. Is the Duke of Devonshire lord of the manor?—Yes.

13,385. Does he receive market tolls?—The lessees do.

13,386. Would he not accept the local board as lessees of the market?—Yes, at the expiration of the lease.

13,387. What length of time has it to run?—65 years.

13,388. Can you put in a copy of your byelaws?—I will do so.

13,389. And also if you please a copy of the Keighley Improvement Act?—It shall be put in.

13,390. Is it the intention of the board to apply for any additional powers?—Yes. They are applying to extend their gas supply and their waterworks, and also for additional powers and provisions for the improvement of the town; also to prevent the pollution of the river Worth and the North Beck.

13,391. You will have, in fact, I suppose an Improvement Bill before Parliament?—Yes.

13,392. Have you served the necessary notices?—Yes; we expect to deposit our plans on the 30th.

13,393. If you will put in a copy of your bill we shall then see what all the projected improvements are?—Yes, I will put it in.

13,394. What is the amount of your present debt?—We succeeded the old commissioners under the Improvement Act, a copy of which I will hand in.

13,395. How many commissioners were there?—A great many.

13,396. Were they qualified according to rateable value?—No, they were named in the Act of Parliament.

13,397. How long did they continue in office, or were they re-elected?—I fancy they were self-elected.

13,398. Then it was an in and in election?—Yes.

13,399. Did they hand their debt over to you?—The only debt was the debt connected with the gasworks and it was a very beneficial debt.

13,400. The old commissioners had arranged to make gas for the town?—Yes.

13,401. And they handed over to you the works and their debt?—Yes, and very beneficial it was to the town.

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13,402. Did many of the old commissioners get elected as members of the local board?—Some of them, but not many; three or four at the first election.

13,403. There was nothing to prevent them being so elected?—No; I believe that those who became candidates were elected.

13,404. You have said that it is your intention to extend the gasworks?—We intend to extend the gas supply. The proposed extension of the gasworks will be on the same site.

13,405. Do you also intend to extend the supply from your waterworks?—Yes, we must necessarily extend the waterworks.

13,406. Do you expect that the works when they are established will be self supporting?—Ultimately they will be.

13,407. Do you contemplate levying a rate in aid to begin with?—That will depend upon circumstances. Supposing that we are compelled by Parliament to complete at once all the works which may be necessary, we shall be obliged to resort to a rate, but if they will allow us to take the works as we want them, we think that they will be self-supporting.

13,408. You must define clearly and completely what scheme you require?—Yes, our scheme is defined, the North Beck scheme is understood and defined. If Parliament will give us a number of years to carry that out instead of the usual three years, then it will be probably not necessary to have a rate.

13,409. Do you anticipate any income from the sale of water for manufacturing purposes?—Yes.

13,410. Do you know the volume that is contemplated to be brought in?—No.

13,411. Did you hear the engineer who was examined say that 23 gallons per head were the volume he contemplated for trade purposes and domestic purposes?—Yes.

13,412. Do you sell any of your water now for trade purposes?—I believe it may be sold to one or two parties but such sale is against the provision in the present Act; it is done illegally.

13,413. Have you discussed at your board the propriety of carrying out a more complete system of sewerage?—Yes, many times.

13,414. Have you discussed the propriety of draining, paving, and channelling the new streets which have been made?—Yes, and a great many new streets have been drained, paved, and channelled.

13,415. Are there some now that have not been so treated?—Yes.

13,416. If you drain, pave, channel, and sewer, you will add necessarily to the amount of the sewage which will find its way into the river?—Yes.

13,417. Have you discussed the probability of your being allowed continuously to pass the sewage into the river Aire?—Yes.

13,418. Do you think that you will be allowed to do so?—I think that we shall not.

13,419. Have you at all considered what you are to do with the sewage if it is not allowed to be passed into the river Aire as now?—There was a scheme for making reservoirs for filtering in order to prevent all foul deposit from going into the Aire.

13,420. May we assume that your board have anticipated that some provision must be made for disposing of the sewage otherwise than by passing it into the Aire?—They have anticipated that.

13,421. May we assume that when the time comes they will fairly and honesty discuss the question and do the best they can?—Yes.

13,422. They will endeavour to comply with any moderate law that may be enacted?—Yes, I have seen no signs otherwise. I was the first clerk elected after the constitution of the board of health in 1855, and I believe that the board would do everything they could to obey the law as soon as they knew what the law was.

13,423. Do any manufacturers in conducting their own special business of washing or dyeing to your knowledge pollute the streams by putting their refuse water in?—Yes, they pollute the water.

13,424. Do any of them pass ashes or other solid refuse into the river?—Yes.

13,425. Have you as a local board any power to stop that practice?—Not as a local board but as improvement commissioners we have powers under the Act.

13,426. Do you retain in your provisional order the powers which were exercised under the Improvement Act along with the Public Health Act?—Yes, some of them; some have been repealed. The 75th section of the 5th of George the IV., chapter 23, called the Keighley Improvement Act, enumerates a whole host of offences to which you may wish to refer.

13,427. Have you read that Act so as to understand it?—Yes, I think so.

13,428. Do you consider as a lawyer that it will hold water?—No; besides we have had a decision of the Court of Queen's Bench against us.

13,429. For attempting to act upon that clause?—Yes; it was decided that we had not the power, although it had been assumed that we had.

13,430. Have you had occasion to test the legal applicability of that clause 75, have you attempted to apply it?—I will explain the matter if you please in my own way. Soon after the constitution of the local board complaints were made by several members of it of the state of the North Beck and the river Worth. At that time I was consulted as to what powers the local board possessed to prevent pollution in the way complained of, and I gave it as my opinion then that the powers which we possessed were defective and that it would be quite futile to attempt to carry them out, and also expensive. Things went on in that way from 1855 to 1864, and in 1864 an opinion was produced that had been given by the late Mr. Robert Hall, who was a very sound lawyer, a member of the northern circuit, and recorder of Hull. His opinion was that we had power to prohibit the pollution, or rather the obstruction, caused by ashes and other things being deposited in the beck, inasmuch as the North Beck might be proved to be a common sewer. The board, knowing that that was the opinion which had been given by Mr. Robert Hall, directed me to apply to Sir George Grey, which I did through "The Local Improvement Act Office," and the answer that was received from Mr. Tom Taylor was that the Act was sufficient to prevent that pollution. Upon that the board directed a prosecution at the very first opportunity of one of the manufacturers who had been detected in polluting the river. But before that, and immediately on their receiving the letter from Mr. Tom Taylor, the board issued the following placard, which I will read, "Keighley Local Board of Health. "Notice to persons throwing or depositing ashes in, "or otherwise stopping up or impeding the passage of "any common sewer, ditch, or watercourse, within "the limits of the district of the said local board of "health. Whereas under and by virtue of an Act of "Parliament, made and passed in the fifth session of "Parliament of His late Majesty King George the "4th intituled, 'An Act for paving, lighting, cleans-"'ing, watching, regulating, and otherwise improving "'the town of Keighley, within the parish of Keighley, "'in the West Riding of the county of York,' certain "powers are vested in the above-mentioned local "board, as successors to the Commissioners appointed "by and in pursuance of the said Act, for the im-"provement of the said town of Keighley, in the 75th "section of which said Act it is more especially men-"tioned that 'if any person shall for the purpose of "'collecting manure or for any other purpose stop up "'or impede the passage of any common sewer, ditch, "'or watercourse, every person so offending shall for "'each and every such offence forfeit and pay any "'sum not exceeding 5*l.*; and it shall be lawful for "'any officer appointed by virtue of the said Act, or "'for any constable or peace officer, to take away and "'remove any of the before-mentioned obstructions, "'in case the party occasioning the same shall not "'remove the same within a reasonable time after "'being required so to do by any person or persons "'whomsoever; and it shall be lawful for any con-

" ' stable or other peace officer, or any one of the said " ' Commissioners, or any officer or other person acting " ' by or under their authority, by virtue of the said " ' Act, and without any warrant whatsoever, to seize " ' and apprehend any such offender or offenders as afore- " ' said, and forthwith to convey him, her, or them before " ' some justice or justices of the peace for the said " ' Riding in order to his, her, or their conviction of such " ' offence ; ' and whereas certain persons have, con- " trary to the provisions of the said Act therein-before " set forth, from time to time contravened the same by " placing or depositing ashes, rubbish, and other ob- " structions in the common sewers, ditches, and water- " courses, within the district of the said local board, " and more particularly in the beds of the North Beck " and river Worth, both within the board's district, so " that the same have now, in consequence of such prac- " tice, become a great nuisance and injurious to the " health of the inhabitants and ratepayers within the " said district ; Now, therefore, notice is hereby given, " that the above-mentioned local board of health " have determined to put in force the provisions of the " said Act herein-before set forth, and all other powers " and authorities vested in them by the said Act, or by " any other Act or Acts of Parliament whatsoever, " and to enforce the penalties against parties contra- " vening the said provisions; and that all future " offenders will be prosecuted as the law directs.—By " order, William Burr, law clerk. Keighley, 12th " October 1864." That placard was to caution the manufacturers and others from depositing their ashes in the becks, but, as I have stated before, one of the manufacturers was afterwards detected in throwing ashes in the usual way into the North Beck. The local board was then driven to this necessity: They must either test the correctness of Mr. Robert Hall's opinion by an indictment at the Quarter Sessions, or by some cheaper proceeding, or let the matter fall through On consideration it was thought better to summon the offending party before the magistrates and get the evidence in there and then ask the magistrates to grant a case for the Court of Queen's Bench in order that we might have a decision as effectually and as cheaply as possible. I may say that our board take very great care of their money. The matter came before the magistrates, and the magistrates decided against the board, on the ground that the North Beck was not a common sewer. The case was then taken before the Court of Queen's Bench, and the other day it was decided against the board; it is reported in the "Leeds Mercury."

13,431. Of what date?—Thursday, November 26th.

13,432. On what day was the decision given?—The day previously; the whole case will be found in the report of the law proceedings on that day. We apprehend that this decision is a very valuable one to us just now, as we are making application for new powers under a new Improvement Bill, as we might have been answered and told that we had already power to prevent pollution, and if so it might have been difficult to get new powers, but when we have this decision pronounced in the highest Common Law Court of the country that we have not these powers, we think that there will be no difficulty in getting new powers to prevent the excessive pollution of these two waters, the North Beck and the river Worth.

13,433. I suppose if you obtain such powers as you are seeking to get you will have no jurisdiction beyond your own boundary?—Unfortunately not.

13,434. The rivers might be polluted above the town to the same extent as they are now polluted by parties below the town?—Yes, they might be.

13,435. Therefore, the new powers that you are seeking will be effective only within your own district?—Exactly so.

13,436. If it became a matter of expense to keep the beck clean, manufacturers within your district would labour under a disadvantage as compared with others who were outside?—Undoubtedly.

13,437. (*Mr. Harrison.*) That leads to the necessity for a more general Act than the mere local one for which you mean to apply?—It shows that there is a necessity for a more general Act.

13,438. (*Professor Way.*) Is not that likely to be the answer which will be made to you in the Committee of Parliament, namely, that you had better wait for a general Act?—We have appealed for this power, and the highest common law tribunal in the land say that we do not possess the power which the words seem to give us; of course, we cannot exercise power which we do not possess.

13,439. (*Chairman.*) Supposing that you possessed the powers which you seek within your own district, is it your opinion, as law adviser to the board, that you could do a great amount of good irrespective of any powers beyond your district?—No doubt of it.

13,440. You could do good to your district and not seriously, if at all, injure the manufacturers?—I do not see how we should injure them. A great many manufacturers have voluntarily given up the practice of throwing ashes into the beck.

13,441. Are there many manufacturers upon your local board?—There are some.

13,442. A manufacturer, if elected, may serve upon the board?—Yes.

13,443. We shall see the clauses which you propose when we see your bill?—Yes.

13,444. Who are your Parliamentary agents?—Messrs. Sharpe, Parker, and Jackson of 41, Bedford Row.

13,445. Then we can get a copy of the bill from them?—Yes.

13,446. (*Professor Way.*) Do the powers which you seek refer solely to ashes and such solid matter, or to the refuse of wool scouring, for instance, and dyeing?—They go to pollution generally.

13,447. Suppose that you were to put your own people under an embargo with regard to the pollution of the rivers, whilst the outside manufacturers were left unrestrained, would not that injure your people, and therefore make it more difficult for them to comply with any law?—I do not think that it would much.

13,448. One of the advantages derived from a law compelling each manufacturer to do his part towards the purification of the stream is that each has good water coming down to him free from impurities caused by other parties situated above him on the stream?—Yes.

13,449. But if you stop short at some limit your manufacturers will not have the benefit of the clean water, whereas they will have the disadvantage of having to clean their own water, is not that so?—To a very great extent.

13,450. Would not that increase the difficulty of legislating and dealing with the question, would it not have a tendency to make your manufacturers discontented with the measure?—The view which I, and I think the majority of the board take, is this: that throwing in ashes is really not necessary, and does not benefit manufacturers at all, and that with the exception of the expense of a few shillings for leading them away, they would not be damaged at all by a law forbidding ashes to be cast into running streams, they can use ashes elsewhere if they think proper. But if we were to carry out a stringent power as to liquid refuse, and to say, "You shall not foul the water at all," we might do manufacturers a serious injury, and a trading district does not wish to injure trade, it lives upon trade, and would not attempt to do anything of the kind; it seems enough to say, "Do not make the thing worse than is necessary." I hope that there will be a general measure.

13,451. (*Chairman.*) Has the town been at all damaged by floods within your knowledge?—Some little damage has been done during the last flood. I am not aware of any previous flood, but there are people who have lived in Keighley for all their lives, the surveyor and others, who will be able to speak upon that point.

The witness withdrew.

KEIGHLEY.

Mr. G. Dryden.

27 Nov. 1866.

Mr. George Dryden (Bingley) examined.

13,452. (*Chairman.*) You are one of the improvement Commissioners of Bingley ?—I am.

13,453. How far is Bingley situated from this place ?—About four miles.

13,454. What is its population ?—There are about 6,000 inhabitants in the town itself, about 10,000 taking the parish.

13,455. Over what area have you jurisdiction as Imperial Commissioners ?—I could not state the number of acres, it would be about half a mile each way.

13,456. How long have you been a member of that Commission ?—About three or four years.

13,457. Is it a Commission acting under a Local Act ?—Yes.

13,458. How many Commissioners are there ?—About 30.

13,459. Do they qualify ?—Yes ; by rating and by property.

13,460. Are they elected by the ratepayers ?—They are not elected by the ratepayers, they are appointed by the Commissioners.

13,461. Then it is a self-elected and self-electing body ?—It is.

13,462. How long has it been in existence ?—About 12 or 15 years.

13,463. Does any stream flow down into and through Bingley ?—Yes, the river Aire flows through Bingley, down the west side of it.

13,464. Is there a beck called Harden Beck ?—There is.

13,465. Have the recent floods had any effect upon property in that district ?—Decidedly, a considerable effect. They have destroyed the banks very much and have flooded the fields and they have done injury in very many ways.

13,466. Are there many manufactories above Bingley on the stream ?—On the Harden Beck there are several.

13,467. Have those streams, or has the river at that point, been at all impeded by solids being thrown in ?—Decidedly so ; very much so.

13,468. And have the beds been raised ?—I have no doubt of it.

13,469. What kinds of solids have been thrown in ?—All sorts of things which you can fancy as being used by cottagers ; everything seems to go in. I am now speaking more particularly of the Harden Beck ; almost everything which has to be thrown out of the cottages is thrown into the beck.

13,470. Is the village of Bingley sewered ?—It is.

13,471. Where do the sewers empty themselves ?—They empty themselves chiefly into the river Aire.

13,472. Is there any water supply ?—There is a good water supply.

13,473. How is water supplied ?—By springs in the immediate neighbourhood.

13,474. The inhabitants get their water from wells and springs ?—They get their drinking water from springs exclusively. It is carried by pipes to a reservoir and thence immediately into the town and it is distributed into the houses.

13,475. Are there many waterclosets in use in Bingley ?—Not a great many, they are exceptional.

13,476. Do such waterclosets as there are drain into the beck ?—Generally speaking they drain into reservoirs.

13,477. Into dumb wells ?—Yes.

13,478. And the liquid overflows or soaks away into the subsoil ?—Yes.

13,479. In what condition do you find the water of the river as it flows down through Bingley, is it bright coloured or is it foul ?—There are no mills above us except a flour mill. A large shoddy mill up to February last was occupied by a gentleman of the name of Worms, and the refuse water which came from it was exceedingly adulterating to the river. I have sometimes seen the river almost as dark as the water of the beck. The river passes at the foot of a garden which I occupy and I have seen the water almost as black as soot.

13,480. Is the beck fouled as well ?—Yes, the Harden Beck.

13,481. By what is it fouled ?—It is fouled by the water which comes from the mills above and also by whatever is thrown in. At Harden Beck the cottages are almost level with the beck, one side of the cottages forms the boundary of the beck.

13,482. The beck washes the walls ?—Yes. I think that there is a little improvement at present but up to almost this period whatever was to be thrown out, the refuse of their washing and so on, found its way into the beck.

13,483. What has been the state of health in those cottages ?—I should wish particularly to allude to that. This year the rainfall has been very considerable and the temperature of the atmosphere has been very low, and consequently they have passed this summer with comparatively little typhoid fever, but last year and for a succession of years before that, and always when the summer has been very warm and the sun has been powerful, there has been an immense deal of typhoid fever in those cottages. There may be 40 inhabitants in those houses and last year I should think that not less than 20 had typhoid fever.

13,484. When they are suffering from fever how are they supported, can they support themselves or has the parish to support them ?—They are, generally speaking, supported by the parish. My partner is the surgeon to the Poor Law Guardians and consequently he sees a great deal of those cottagers, and from time to time I have seen a great deal of them. Generally speaking, when fever breaks out amongst them they are obliged to apply to the parish for relief.

13,485. Then, if the fever is caused by any malarrangements of their houses, or impurities in the stream which could be removed by the parish, the parish is now paying for the disease ?—Decidedly.

13,486. Do you think that the parish might spend its money in preventing the disease ?—The money would be spent a great deal better by having the beck in a proper state.

13,487. And by preventing this pollution ?—Yes. Last year the amount of disease prevailing in that immediate locality was so considerable that I made a representation to the chairman of the board of health, and the result was that the proprietor of the cottages was summoned before the magistrates, and he promised that the sanitary arrangements of the cottages should be considerably improved. I believe that they have been to some extent improved. But that inquiry had reference more particularly to the state of the inhabitants, the want of ventilation in the cottages, and the want of cleansing the privies there, and had no reference whatever to the state of the beck, because that did not at all come under the cognizance of the magistrates, or of the parties who were giving evidence. At the same time I simply wish to say that this great amount of disease which has prevailed so much for a succession of years was not altogether from the internal condition of the cottages, but was partly from the quantity of water emptied from the mills above. When the water is low soapwashings and the refuse from mills are brought down, and the stream not being very quick, they are left by the side of the stream, and part of the bank is left high and dry. In warm weather, when the sun is hot, fermentation arises, and there are emanations of several gases—sulphuretted hydrogen, and sulphuretted carbon, &c.—in short, a poisonous state of things. I have seen that form of disease at Harden Beck so intense that in 48 hours the poison has carried off a man.

13,488. Have you anything like the same amount of disease in the other part of the town ?—No.

13,489. Then, do you connect the dirt and the disease together as cause and effect ?—I do.

13,490. As Improvement Commissioners have you

any power to remedy that state of things?—No, because that is beyond our boundary.

13,491. (*Mr. Harrison.*) Within your own boundary do you take steps to prevent nuisances of the sort?—We have a surveyor of nuisances, and he is constantly taking steps in order to bring about a better sanitary state of things. For instance, for a succession of years privies have been built over residences, and residences over privies; notices have been given with regard to those privies, and they are about to be entirely removed, they are not allowed to be continued any longer.

13,492. How are they cleaned out from time to time?—They are cleaned out at a certain time appointed in the evening or before a certain time in the morning; the contents have to be carted away under the direction of the Improvement Commissioners; they are not allowed to be taken away in mid-day.

13,493. And your inspector looks to it to see that they are cleaned out from time to time?—Yes, care is taken, and from time to time there is an inspection by the Improvement Commissioners to see that the deposits of night-soil are clear.

13,494. Is that soil taken into the country and put upon land?—It is taken into the country, generally by farmers who put it on to their land in the outer districts.

13,495. Have you found beneficial effects to result from this system of inspection and constant cleansing?—Decidedly, there is no question about it.

13,496. (*Professor Way.*) You have spoken of the refuse matter coming down from the mills, and when the water is low attaching to the sides of the stream?—Yes.

13,497. That is principally soapsuds?—Soap-washings and all those materials.

13,498. Is there any dyeing produce?—I think not. The mill which I spoke of was a shoddy mill for separating the cotton from the woollen in order to make use of the wool.

13,499. That was an exceptional kind of mill?—Yes.

13,500. Do you know at all what other source of pollution there is from these mills which you speak of besides soapsuds?—No. So far as I know almost everything is thrown into the becks. Unfortunately manufacturers have been in the habit of polluting the becks, and consequently their tenants and cottagers seem to have no objection to follow the example of the millowners.

13,501. Do the mills employ a great many hands?—Yes.

13,502. Where are their conveniences emptied?—They use ashpits and privies.

13,503. I suppose the refuse is not thrown into the beck?—No.

13,504. Do you imagine that there is anything seriously injurious in the smell of the soapsuds?—In speaking of the Harden Beck particularly, where we have had so much disease, and so much fever, you not only have the soapsuds, but you have the refuse of all kinds from cottages.

13,505. Human excrements?—Yes.

13,506. And are pigs kept?—Yes.

13,507. Then the brook is very foul?—Yes; so much so, that we were obliged to make a representation to the chairman of the board of health, the result of which was a hearing before the magistrates, and a promise to remedy the evil.

13,508. I suppose that the water is in a frothy condition?—Yes.

13,509. Which would tend to make the gases given off more objectionable?—Yes, and the cottages are on a very low level. There is a constant emanation of gases; and from what we have seen from year to year, they are of a very poisonous and deleterious character.

13,510. You have no hesitation in referring the disease and death of which you have spoken to the condition of this stream?—Partly to the condition of the stream, and partly to the want of ventilation, and of cleanliness in the cottages.

13,511. We may take it, that the uncleanliness of a stream of water running past cottages is so far an inducement to the want of cleanliness in the cottages themselves?—Precisely.

13,512. As for instance, in not supplying sufficient pure water for domestic cleaning?—Yes, and the people are in the habit of throwing everything which you can imagine into the stream, so as to obstruct the flow of the stream, and the gases accumulate in large quantities.

13,513. I suppose that familiarity with dirt produces a kind of moral obliquity to dirt?—Precisely so.

13,514. If a pure running stream were at the back of these cottages, the probability is, that the inhabitants of them would be more cleanly?—Yes, and it was so originally. I have resided in Bingley for 34 years; when I first came to Bingley there was nothing of this kind; they never thought of such a thing. In those days the people estimated the value of pure water, but now, cottagers seem to follow the example of millowners, and the water is very much deteriorated.

13,515. (*Mr. Harrison.*) Have you observed much change in the river Aire, as well as in the Harden Beck?—Yes. The garden which I have goes down immediately to the river Aire, and during 34 years I have watched the floods. I observed the other day that the water did not rise so high by any means as it has done on former occasions; but I observed that it came down much more rapidly.

13,516. You mean in a quicker time?—Yes.

13,517. It reached Bingley sooner after a heavy rain?—It reached Bingley sooner, and passed Bingley sooner; it went in a very rapid stream indeed.

13,518. Is it the case, that the land above Bingley was more flooded than usual?—The land was more flooded than usual, and the stream accumulated in a very much shorter time.

13,519. If the water did not rise so high, and yet passed more rapidly, how do those facts agree with the land being flooded more than before?—It seems to me from the observation which I have made, to amount to this; that so long as the river continued in its original bed, and did not much overrun the banks, the increase of damage done was confined to the banks, but when the river rose several feet above the banks, as it did very rapidly, the collateral waters seemed to impede the running stream.

13,520. Has the bed of the river at Bingley risen within your recollection?—Yes, no doubt it has risen, though I cannot say to what extent.

13,521. As your garden abuts upon the river you would be able to observe it?—Yes.

13,522. And it has done so within your knowledge?—Yes.

The witness withdrew.

Mr. William Smith (Keighley) examined

13,523. (*Chairman.*) You are of the firm of Messrs. J. and S. Smith?—Yes.

13,524. You are machine makers?—Yes.

13,525. Where are your works situated?—On the banks of the river Worth.

13,526. What number of men do you employ?—Between 400 and 500.

13,527. What area of ground do you occupy?—About 5,000 square yards.

13,528. Do you use the water for any purposes either of power or in any way in your manufacture?—For the engines.

13,529. What engine power do you employ?—About 40 horse.

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13,530. What weight of coal do you consume per annum?—About 1,500 tons.

13,531. What do you do with the ashes?—We cart them away.

13,532. Have you always carted them away?—No.

13,533. How long have your works been situated upon that site?—Between 40 and 50 years.

13,534. Did you formerly throw your ashes into the stream?—Yes.

13,535. When did you cease to do so?—When the local board of health gave public notice that we were to discontinue that practice.

13,536. When was that notice given?—About 18 months ago.

13,537. Does it cost you anything now to remove your ashes?—It costs us 1*l.* a week.

13,538. Do you think that a very great hardship?—I do not.

13,539. You think that the ashes ought to be removed, though it costs you 1*l.* a week?—Yes.

13,540. And if every other person was obliged to do the same you would not wish the privilege restored to you?—I would not throw my ashes into the stream whether anybody else did so or not.

13,541. Have you been at all affected by floods in that stream?—Yes.

13,542. Is the bed of the stream any higher than when you first knew it?—Yes, far higher.

13,543. Opposite your place?—Yes.

13,544. Do you think that that is partially caused by people throwing in ashes above you?—Decidedly.

13,545. Then do you think that you have assisted to raise the bed of the stream below you?—Yes.

13,546. This system of throwing in solids necessarily raises the beds of the rivers?—Yes.

13,547. And would you say that it necessarily produces a flooding?—Yes.

13,548. And a more injurious effect?—Yes.

13,549. And if Yorkshire manufacturers go on throwing solids into the rivers they may expect their works to be flooded more than they have been?—Decidedly so.

13,550. Have you any idea what extent of loss has been suffered by this last flood?—I know that neighbours of ours have had their foundries flooded 18 inches deep and it has cost them a large amount of money. Some of their engines have been flooded and the fires put out, and their hands have been walking about the streets. That is all on account of the bed of the river having been raised.

13,551. Was that notice as to putting ashes into the stream served upon everyone as well as yourselves?—It was placarded in the streets. I am not aware that we had one personally.

13,552. Has there been a general abatement of the nuisance in consequence?—Yes.

13,553. Are you a member of the local board?—Not at present.

13,554. You have been?—Yes.

13,555. And may be again?—I do not know.

13,556. That would depend upon yourself and others?—Just so.

13,557. Is there much obstruction to the stream opposite you and above you by persons throwing in refuse?—Not at present.

13,558. You think that that has been abated generally?—Yes.

13,559. (*Mr. Harrison.*) Has the late flood at all raised the bed of the Worth?—I do not know that it has.

13,560. Has it at all lowered it?—I believe that it has.

13,561. Do you anticipate that if ashes and other refuse were prevented from being cast into the river the result in course of time would be a lowering of the bed of the river?—I believe so, and I believe that there are means by which that can be considerably accelerated.

13,562. What are those means?—We have damstones about 120 yards below the low bridge. The refuse might all be carried away, only however to another place.

13,563. Do you know the river Aire between the Worth and Bingley?—Yes.

13,564. Do you know whether the bed there has been raised?—Yes, it has been.

13,565. Is that rather a level part of the river?—Yes.

13,566. Below Bingley the river is rather more rapid?—I believe that it is.

13,567. How many years have you been connected with these works?—About 40 years.

13,568. That goes back to a time before there were railways in this neighbourhood?—Yes.

13,569. What is the difference at Keighley now in the price of coals as compared with the time before railways were made?—About 3*s.* a ton.

13,570. What do you get coal at Keighley now for?—We give about 8*s.* 6*d.*

13,571. You are almost as well off now as manufacturers in the neighbourhood of the coal fields?—There is very little difference.

13,572. Do you get coal for 3*s.* a ton less than you formerly did?—No, I mean 3*s.* more.

13,573. (*Chairman.*) Even though you have railways?—Yes, but we would not be without the railways for all that.

13,574. (*Mr. Harrison.*) Do you mean that the cost of coal now at Keighley is 3*s.* a ton more than it was before the railway was made?—Yes.

13,575. (*Chairman.*) Then I suppose that it is the greater consumption which has raised the price?—Yes.

13,576. (*Mr. Harrison.*) Where did you get your coals from before the railway was made?—Partly by canal, and partly from a place about seven miles from here.

13,577. Is the coal being worked out?—They are not getting so much as they did.

13,578. Still 8*s.* 6*d.* a ton appears to be as favourable a price as that at which mills in the immediate neighbourhood of the coal field get their coals?—I daresay it is.

13,579. Keighley seems to be advantageously situated in respect of having a good supply of water in the immediate neighbourhood?—Yes.

13,580. So that you have two of the principal elements of progress?—Yes, we are very well situated.

13,581. And the probability is that Keighley will be an increasing town?—Yes.

13,582. (*Professor Way.*) Have you ever ascertained what amount of ashes you produce?—About 1,000 tons.

13,583. On 1,500 tons of coal?—Yes, but you must understand that all our refuse from the foundry and the shop is accumulated.

13,584. (*Chairman.*) You do not mean to say that you have 1,000 tons of ashes out of 1,500 tons of coal?—No, I mean the total refuse produced at our works.

13,585. Have you any idea what amount of ashes you would have from consuming a ton of your coal; would it be one-third, or one-fourth, or one-fifth?—I do not think that it would be much above one-third.

13,586. Do you think that it would be one-third?—Yes; ours is what we call an inferior coal.

13,587. (*Mr. Harrison.*) The amount of ash depends partly upon the coal and partly upon the way in which it is consumed?—Yes.

13,588. (*Chairman.*) How many boilers do you use?—We have two boilers.

13,589. Of what kind are they?—They are Cornish boilers.

13,590. Do you make smoke?—Yes.

13,591. At your chimney top?—Yes, and at the bottom too.

13,592. Do you not think that you could do without making it?—Yes.

13,593. That is to say, if you had the same restriction as you have with regard to the ashes?—Yes.

13,594. You would not then send out smoke?—Not so much.

13,595. I suppose that now you are not required to prevent it, and do not pay attention to it ?—We pay a little attention to it.

13,596. It is more a matter of careful firing than anything else ?—Yes.

13,597. You want a better man, and to pay him better ?—Yes, and we want something else besides.

13,598. If you paid him so much more per quarter upon condition that he did not produce smoke, and if you deducted fines from his wages if he did produce smoke, he would soon find out a way not to produce smoke ?—Perhaps he might.

13,599. Is there anything further which you wish to state to the Commission ?—No, except that the effect of the bed of the river having been so raised is to dam up some drains, and the cellars of the cottages are flooded.

13,600. How many cottages do you think are so situated as to be thus affected ?—I should think a dozen in our neighbourhood.

13,601. I assume that when that takes place, it is a serious inconvenience to those poor people ?—Decidedly so.

13,602. Do you think that it is liable to cause disease ?—Yes.

13,603. If it dees not cause disease it causes great inconvenience ?—Yes.

13,604. And they are powerless to help themselves ?—Decidedly. The water comes up the drain.

13,605. Do you think that the bed of the stream has been raised since those cottages were built and the drains were made ?—Decidedly so.

13,606. How long have they been built ?—Some of them 12 or 14 years.

13,607. Then within that period the bed of that beck has risen sufficiently to back water the drains, and to flood the tenements ?—Yes.

13,608. Is it their cellars or simply their ground floors that are flooded ?—Their cellars.

13,609. Are they occupied at all ?—Not to live in.

13,610. When those drains are flooded in that way, I assume that foul water will be driven back from the drains ?—Yes.

13,611. Which will make it far worse than if it was only the river water ?—Yes. I have been called in when the cellars have been flooded with sewage as black as soot.

13,612. And stinking ?—Yes.

13,613. Could not your local board do anything to remedy that state of things ?—We tried our best. We diverted the drain in order to get a lower fall for the purpose of getting that water away.

13,614. But it is not available ?—It is not available when a flood comes.

The witness withdrew.

Mr. William Cockshott (Keighley) examined.

13,615. (*Chairman.*) What are you ?—A fellmonger.

13,616. Where are your works situated ?—Adjoining the North Beck.

13,617. At the lower part of the town, or the higher part of the town ?—At the low part.

13,618. How long have you known that beck ?—Above 50 years.

13,619. In what state is it now as compared with what it was when you first knew it ?—When I was a boy there were plenty of fish in it, and likewise it was lower by four feet or more than it is now.

13,620. What has raised the bed of that beck ?—Refuse turned in by persons above.

13,621. What number of men do you employ ?—We do not employ many, not above three or four.

13,622. What kind of rubbish has been thrown in to cause that raising of the bed of the beck ?—Principally ashes and refuse from foundries, as well as other rubbish from foundations.

13,623. And scrapings of highways ?—There is no doubt plenty of that.

13,624. In fact, I suppose that formerly persons threw in anything which they liked ?—30 years since, a gentleman who occupied a mill paid very great attention to that matter ; he had the right of the water and then no one dared put in anything.

13,625. Did he die ?—He gave up the business.

13,626. And no other person took up the right ?—There has been one since, but he has been obliged to stop his water-wheel ; it was made fast.

13,627. Have you known any of these town drains back-watered ?—Yes.

13,628. Is the water discoloured by the refuse water thrown in ?—Very much.

13,629. What is the principal discolouring matter ?—Of late there has been quite a puddle, by flushing out mill-dams.

13,630. They flush them into the beck when they like ?—Yes, which matter no doubt would make good tillage if it was taken care of.

13,631. Have you known any losses suffered by flooding from the beck ?—We have suffered ourselves. In the last flood if we had not taken precaution we should have lost above 100*l.* Our yard was four feet deep in water which has never been flooded before.

13,632. If the beck had been four feet lower, as it was when you first knew it, you would not have been flooded at all ?—Not at all. Above our premises I have known as much as 30 cart loads of refuse per week put into the beck which there is about 40 yards wide, and I have known the bed almost filled up, so that I could go over it.

13,633. By people tipping in on each side ?—Yes.

13,634. When a flood came would it take away all that refuse ?—Not altogether.

13,635. It would take some of it away ?—Yes.

13,636. Do you remember the order being given by the local board for people to discontinue throwing in those solids ?—Yes.

13,637. Has the stream been better since then ?—A little. Parties have still continued putting refuse in.

13,638. That evil is not quite cured yet ?—It is not.

10,639. And I suppose that if people within the district of the local board ceased to throw in those solids it would not necessarily affect the people outside, either above or below you ?—It would not.

13,640. Then do you think that it is requisite that there should be some power to regulate these streams, and to prevent their being filled in this manner ?—By all means.

13,641. Do you think that if the practice goes on property may be injured and life sacrificed ?—Yes.

13,642. In what way ?—A street adjoining our property, which had never been flooded before, was flooded 100 yards and more.

13,643. The surface of the street ?—Yes.

13,644. And were the floors of the dwelling houses flooded ?—I believe that on one side they were, on the other side they are a few steps above the street, and perhaps the water would not get so high.

13,645. Are you a member of the local board ?—I am not.

13,646. Do you make any refuse upon your premises ?—Very little, and what we put in is liquid ; it is spent lime-water.

13,647. Would it be very difficult for you to keep that out ?—I do not know that it would.

13,648. Do any solids come from your manufactory ?—No.

13,649. (*Professor Way.*) What is the particular business which you carry on ?—Taking off the wool from sheep skins.

13,650. What number of sheep skins have you in the course of the year ?—We have sometimes 600 a week, but now we are doing about 200 a week.

13,651. Do you steep those skins in lime ?—Yes, and we then pull off the wool.

13,652. In what form is the lime ?—In a liquid state.

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We take burnt lime and put it on the skins and let them lie for 48 hours and then they are washed. We want clear water for our purposes. When the lime has gone into the skin we draw off and the spent lime-water flows down into the beck.

13,653. Do you put on the lime dry in the first instance?—No, in a liquid state. We put the skins into water first and wash them over with lime and a little water.

13,654. After a time they are washed?—Yes.

13,655. Are they washed in a tank?—Yes.

13,656. Are many skins put into the same tank, or is water running through it all the time?—Water is running through it all the time. It comes from the dam-stones into our tank and we wash the skins there, and then it passes into the beck again.

13,657. What is the size of the pipe?—Three inches, that is constantly flowing.

13,658. Then anything which the tank carries goes into the beck?—Yes.

13,659. Do you think that such a large quantity of water is necessary for you?—Yes. We used to wash at the dam-stones.

13,660. In that tank I suppose there is very little solid which remains?—Very little.

13,661. What quantity of lime do you use in a year?—Perhaps a cart-load a month.

13,662. And such as it is, after it is spent, it goes into the stream?—Yes. Quick-lime will kill fish, but I do not think that this lime-water will.

13,663. It goes out in a milky state, I suppose?—Yes.

13,664. What are these skins used for?—For leather

13,665. For fancy leathers?—Yes.

13,666. (*Chairman.*) Do you split the skins?—No, we sell them in the whole state and they go to be split afterwards.

13,667. But they are split?—Yes.

13,668. (*Professor Way.*) Do you wash the wool after it is taken off the skins?—No, before.

13,669. And it is sent direct away?—Yes.

13,670. That is the only thing which you do?—Yes.

13,671. And that is the only sort of skins with which you deal?—Yes.

13,672. Can you form a notion of the quantity of water which you use in 24 hours?—No.

13,673. (*Mr. Harrison.*) What head of water have you?—Perhaps it may be 1 foot fall, we have a pipe continually running.

13,674. If you were forbidden to throw that water into the stream again what would you do with it?—We should have to filter it.

13,675. I suppose that the lime gets changed into carbonate of lime—into chalk, does it not?—I do not know.

13,676. If you were to separate that part which is in suspension, do you think that the water would go away pretty clear?—Yes.

13,677. If you leave the skin too long which is destroyed, the wool or the skin?—The skin.

The witness withdrew.

Mr. JOHN MILLIGAN (Keighley) examined.

Mr. J. Milligan.

13,678. (*Mr. Harrison.*) I believe you are surgeon for the parish of Keighley?—For the Keighley district. I was originally surgeon for the whole parish but it was divided 10 years ago.

13,679. How long had you been surgeon for the whole parish?—From 1839; from the organization of the union.

13,680. We have had it mentioned that the population is now about 18,000 or 20,000, what was it in 1839?—I cannot speak distinctly to that point. There has been no great increase from 1851 to 1861.

13,681. What is the death rate in the parish of Keighley now?—I could not say unless I looked over papers. I can furnish that information to the Commissioners. I shall have to consult the registrar first.

13,682. How is it as compared with 1851 or 1839? We have been gradually improving.

13,683. You will be able to give us the facts as to that improvement?—I think that I shall be able to do so after consulting the registrar.

13,684. Have you known the river during that period?—Yes.

13,685. What is its condition now?—As a matter of course the river Aire has become considerably worse than it was, though I do not believe that it is at all so bad as has been represented by some of the witnesses.

13,686. What is the condition of the river Worth?—Our becks here have become deteriorated very much indeed.

13,687. Do you remember when there were fish in them?—30 years ago I remember trout coming up to spawn and jumping the dam stones five or six feet, to get higher up into the river, where there were sandy beds in which they could deposit their spawn.

13,688. And now there are no trout?—No. It was a very common practice for the woolcombers to come and capture trout at the dam stones; those are stones just placed across to give the water a direction down to the wheels.

13,689. Are they placed close together?—Yes; they are very great stones, very strong solid masonry.

13,690. Have you observed whether at those dam stones the bed of the river has risen within your recollection?—It has risen within my recollection five or six feet, and especially at the North Beck.

13,691. What would be the effect of that upon the sewers?—I have only heard of one case of a sewer being checked by back-water, so as not to have a free run.

13,692. Did you hear the evidence of Mr. Smith as to the effect of the raising of the bed in damming back the water in the sewers and throwing it into the cellars of some of the houses?—I did not hear that evidence. Mr. Smith is better acquainted with that matter than I am, as he lives in that part of the town.

13,693. That has not come under your notice as medical officer?—No.

13,694. You were formerly a member of the local board?—Yes, for two years.

13,695. Then would it not have come under your notice?—I only remember the cases of two cellars which were flooded, which I was requested to visit, and that flooding was owing to some defect in the drainage, there not being a sufficient fall.

13,696. When were you a member of the local board?—About a month ago I closed two years' service.

13,697. Did the local board take steps to make a supervision of the dwellings of the poor?—Yes, there was a constant supervision of the dwellings of the poor; in fact the dwellings of the poor have been improved in the last 30 years.

13,698. With a beneficial result?—Yes; my opinion is that we have been gradually improving, and that the death rate has been falling.

13,699. Are there many cellar dwellings in the town of Keighley?—We do not have them, perhaps, in the same proportion as other towns, but we have too many of them. There is a style of dwelling which I very much disapprove of, and which I think disfigures any town, namely, dwellings under balconies; they are something like cellar dwellings.

13,700. Is there a footpath above them?—Yes. Whether those dwellings are with the cognizance or approval of the board I cannot say, but I should very much disapprove of them.

13,701. Do you think that there is much ill health among persons living in those places?—I do not know that there is; they work out of them a great deal; you might go to half a dozen of them and find that there was no one in.

13,702. Is there generally pretty good accommodation as to privies in the town of Keighley?—I

think not; I think that we are very defective in that respect.

13,703. Did your local board take any steps to improve that condition of things?—Certainly.

13,704. What steps did you take?—In the way of purchasing housesteads and removing them, and putting in privies for the accommodation of the people on either side of the street.

13,705. In your practice have you been able to attribute sickness in any case to the condition of things as it was before you made these alterations?—Most certainly; privies close to dwelling houses, or under dwelling houses, are calculated to engender febrile complaints or even small-pox. I remember one case in particular in one of our new streets in this town; there were four or five privies under a house where a family lived; the small-pox came there, and we could not trace it to anything else. Seven grown up people died; in fact the whole family died with the exception of the father and mother. It did not spread further than the house just over these privies.

13,706. That you attribute entirely to those privies?—Yes.

13,707. Were you at all astonished at that result?—Not at all.

13,708. Have you examined the water in the neighbourhood of Keighley?—Some years ago when we were going to erect a new workhouse we were anxious to have a good and pure supply of water; several samples of water were brought to me in vials, for me to say whether they were pure or impure; mine was not a very refined analysis, but it was sufficient to indicate what the impurities were, and we found them to be chiefly lime, the quantity would vary very much in different seasons of the year.

13,709. Mr. Booth mentioned to us this morning that the basin of the Worth is almost entirely on the millstone grit, in fact the whole of the water which comes down to Keighley comes over the millstone grit?—We cannot tell how far the water percolates through the lime rock before it comes to us. I have always found lime in the water, and when you sink wells and pumps it is surcharged.

13,710. (*Professor Way.*) Do you think that the water of some of the wells and springs is really hard water?—I should say that the water of the wells is universally so.

13,711. And that without influence from town drainage?—Independently of the town drainage. In fact, I know one pump where patients have said that they must leave the place or must fetch water from a great distance, and at great cost. That is one of the hardest waters which I have analysed, it would leave a great amount of soap at the top.

13,712. Is it harder water than that with which we are supplied in London?—I am not aware that the Thames water runs in any lime district.

13,713. It runs through the chalk hills and the oolites. When you speak of hardness do you refer to water as hard as the Thames or harder?—There is water here very hard and there is water very soft. If you go a mile out on the Skipton Road the water is very pure, you can scarcely discover any lime in that water; but if you come on this side you will find lime in the water. The same thing prevails at Matlock; on one side of the river you have soft water, and on the other you have hard water, and the two places are within a stone's throw of each other.

13,714. You are here in the habit of calling that hard water which we should not think of calling hard water, that is probably because you have such soft water?—Yes, but all the waters which I have tested here have lime in them, which is a hardening element.

13,715. But you do not attribute any deleterious effects to that?—No, except the water has a very large amount of lime. In the case of the well which we have here the water is very hard.

13,716. (*Chairman.*) Is it sulphate or carbonate of lime?—Carbonate of lime.

13,717. Would it precipitate by boiling?—Yes; and also by exposure to the atmosphere it would become soft.

13,718. (*Mr. Harrison.*) Are there any lead mines in the neighbourhood?—Yes, about seven miles from here; the Duke of Devonshire's mines are between Keighley and Skipton, you there come into contact with the lime rock.

13,719. (*Chairman.*) Are not all the great lead lodes in lime?—Yes.

13,720. (*Mr. Harrison.*) Some of the witnesses have spoken of lead being found in the millstone grit?—It is a very extraordinary event if it is so. The thing which we call millstone grit here is the coarsest and the grittiest of the sandstones.

13,721. Is Bramley fall millstone grit?—That is a specimen of it.

13,722. (*Chairman.*) Is there anything which you wish to add to your evidence?—With respect to the river, I have known the river all my life, having been born in the district; and ever since I have known anything of it it has been very much contaminated by the manufacturers of this town and Bradford, and all the intervening villages. About 20 years ago I took this extract from the "Leeds Mercury." (*The witness delivered in the same which is as follows:*)

"Leeds Philosophical and Literary Society.

"At the last general meeting of this society held "on the 20th instant, an interesting and able paper "was read by William Osburn, Esq., 'On the epigram "and epigrammatic writings of the beginning of the "18th century,' in which the author gave numerous "examples from the writings of Dryden, Pope, Prior, "and others, and concluded with one found written "on the fly-leaf of an old book, which was of so local "a character that we venture to give it:

"'The Aire below is doubly dyed and damned;
"'The *air* above with lurid smoke is crammed;
"'The one flows steaming foul as Charon's Styx,
"'Its poisonous vapours in the other mix.
"'These sable twins the murky town invest,
"'By them the skin 's begrimed, the lungs oppressed;
"'How dear the penalty thus paid for wealth
"'Obtained through wasted life and broken health.'"

(*Witness.*) The river Aire has never been a sweet river since I knew it. I have an old manuscript history of the grammar school of this town, written by one of the rectors 150 years ago.

13,723. (*Professor Way.*) Do you say that ever since you have known the river it has been contaminated by mills between Keighley and Bradford?—Yes.

13,724. I suppose that there was a time when there were no mills?—Yes.

13,725. Then it is only a question of remoteness whether it was once a pure stream or not?—Certainly. I only speak of 150 years ago. Mr. Gale concludes with a few of the pastimes of the place, and he speaks of men catching salmon when they came up to spawn in this river. No doubt the river was pure then. They put up a lantern at the prow of the vessel and the fish were attracted by the light.

13,726. The bulk of the evidence which we have had with regard to the Aire and the Calder is that the great increase of pollution has been within these 20 or 30 years?—I lived in Bradford above 30 years ago, and I have known the contaminations poured down from the dyehouses, from Bowling dyehouse especially.

13,727. (*Mr. Harrison.*) The very fact of the prodigious increase in the weight of wool dyed now in this neighbourhood, as compared with 20 years ago, shows that the increase of pollution must be in proportion?—There is no doubt of it, but I only say that the river has been contaminated by manufacturers during the time that I have been acquainted with it.

The witness withdrew.

KEIGHLEY.

Mr. C. A. Craven.

27 Nov. 1866.

Mr. Charles Alfred Craven (Keighley) examined.

13,728. (*Chairman.*) You are superintendent of the gasworks here?—Yes.

13,729. How long have you been superintendent?—About five years.

13,730. Where are the works situated?—Adjoining the river Worth.

13,731. Does the stream pass your boundary?—It passes our boundary.

13,732. Are your works liable to be flooded by the Worth?—At the last flood the water came up to the underside of our fires, and if it had not fallen all the fires would have been extinguished, and the town would have been in darkness. The water rose up through the gravel.

13,733. It rose into the fireplaces?—Yes.

13,734. And would have put out the retort fires?—Yes, if the flood had risen nine inches higher we could not have helped the fires being put out, and it was only through great exertion that we prevented its being so on that occasion.

13,735. Have you ever known it so before?—No. We have had a man who has been at the works 40 years, and he says that he never knew a flood reach so high.

13,736. Do you think that the bed of the stream has been raised so as to cause the water to rise higher than formerly?—I do.

13,737. Have you known any solid matter to be thrown into the stream above you, such as ashes and foundation material, and refuse of different kinds?—Yes.

13,738. Do you think that that has a tendency to silt up the bed of the stream?—Yes.

13,739. What amount of gas per annum do you make?—39,500,000 cubic feet.

13,740. What amount of coa do you use?—About 4,300 tons.

13,741. What sort of coal do you use for making your gas?—The best ordinary coal which we can use.

13,742. Not the cannel coal?—No.

13,743. Do you use your own coke for roasting the coal?—Yes.

13,744. Do you make any smoke?—No.

13,745. Excepting when you are drawing the retorts?—Yes; there is no smoke from the chimnies.

13,746. Have you any ashes?—Yes.

13,747. What do you do with them?—They are now carted away, but I know that formerly they were thrown into the beck; that was before I can remember.

13,748. You do not throw them into the beck?—No.

13,749. What do you use for purifying your gas?—Dry lime.

13,750. What do you do with the refuse?—It is used for agricultural purposes, we charge 1*s.* 8*d.* a ton for it.

13,751. And you get that price for it?—Yes.

13,752. You get a good price, do you not?—I have known a better price than that. I believe that at York they get about 7*s.* or 8*s.* for it; but that is in the centre of a purely agricultural district.

13,753. I suppose that its value depends upon the nearness of the place where it is to be used?—Yes.

13,754. (*Professor Way.*) Do you use oxide of iron?—No.

13,755. Are you aware that that is a purifier?—I am.

13,756. Is there any particular reason why you have not used that method of purification?—The oxide of iron will not remove the carbonic acid, and we find that the lime which we get answers very well.

13,757. Supposing that you had a difficulty in getting rid of your lime, you might resort to purification by oxide of iron?—Yes, we might then think about it.

13,758. You do not store your lime in any stock?—No.

13,759. Do you get rid of your tar?—Yes; we sell the tar and the ammoniacal liquor.

13,760. How much do you get for the tar?—15*s.* a ton.

13,761. Is not that rather low?—Yes, but we cannot get more here, and we get 7*s.* a ton for ammoniacal water.

13,762. Where does that go?—The tar and ammoniacal water goes to the chemical works down by Bingley, the former to be made into naphtha and creosote and the latter to make sulphate of ammonia.

13,763. You do not turn any of it into the stream?—No, we can sell it; of course it is our interest to preserve it.

13,764. Have you increased your works latterly?—Yes, since I came into the management of the works. In 1862, for the year ending July the 1st, we made 24,618,000 cubic feet of gas; in 1863 we made 17,116,000 cubic feet; in 1864 we made 31,659,000 cubic feet; in 1865 we made 32,522,000, and in 1866 we made 39,481,000 cubic feet.

13,765. To what do you attribute those increases; are the streets better lighted?—Yes; a great many additional lamps have been put up, and there is a great impetus in the iron trade, I believe, for lighting up the new shops; they have begun to singe the yarn by gas, and they also use gas for the combing machines.

13,766. You do not in any way contribute to the impurity of the river?—I believe not.

13,767. When you have to repair a gas holder and to let out the water, what do you do with it?—It must run down, but we have only done that in one case.

13,768. What supply is there to the gas holders?—We have two supplies; we have the spent water from the boilers of two manufactories adjoining our place. We require about 5,000 gallons a day for all our purposes, including the keeping up of the tanks.

13,769. Why do you use that water from the boilers; is it better suited for the iron?—It is cheaper.

13,770. Is not a great deal of that water carried off in the operation itself?—Yes, and in slacking the cinders.

13,771. Have you not to add a great deal of water to the tanks?—Yes; some of the old tanks are not very tight, but we intend some day to pull them out.

13,772. From your experience in gasworks, would you say that the water diminishes in quantity even without any leakage?—In one case, I have known our largest tank to be five or six weeks without any supply of water, the quantity had diminished very little indeed. The main loss in the gasholder tanks is owing to leakage from the bad construction of the tank.

13,773. Does not it depend to some extent upon the cooling of the gas before it gets into the gasholder?—To some little extent.

13,774. The necessity of discharging that water only occurs when some repairs are required to the tank?—Yes, only in some case of emergency.

13,775. (*Chairman.*) What number of retorts have you in use?—About 80 or 90.

13,776. Are they earthenware or iron?—They are both clay and iron; about two years ago we had all iron retorts, we are now doing away with them.

13,777. Do you prefer clay retorts?—Decidedly.

13,778. Do they make better gas?—I cannot say that they make better gas, but the quality of gas is equal to that which is made from iron retorts.

13,779. Do they last longer than iron retorts?—Yes; double the length of time.

13,780. Have you any applications from mothers to bring their children in illness into the purifying house?—Yes; sometimes we have the edges of the purifiers lined with children.

13,781. For what disease do they bring them?—Chiefly for hooping cough.

13,782. I suppose that from the fact of so many coming one after another mothers think that it does their children some good?—Yes, they seem to think so, and I think that it does. I have seen a notice in

the gas journal that some French physicians recommend it very much.

13,783. Have any of your workmen at any time been afflicted with asthma?—No, none that I know of, who have been in the purifying department.

13,784. Do asthmatical people get any benefit by coming in?—We have not many of them coming there, but I believe that they would if they came there.

13,785. What effect has the purifying house upon you if you go into it; is it oppressive to you?—Not at all.

13,786. Is it injurious to the men who work there?—I do not think so.

13,787. Is any portion of the business injurious to the men?—I think not. We have one old man who has been there for 40 years, and he has worked in every department.

13,788. You do not believe in any smells from gasworks being injurious to health?—No, I think not.

13,789. Or that handling or working amongst the tar is injurious to health?—I do not think that there is anything injurious in it at all; in some cases the effect is quite the reverse.

13,790. How long have mothers brought their children to your works?—Ever since I recollect. We give them every facility.

13,791. You do not charge them anything?—No.

13,792. Do they seem grateful for permission to come there?—Yes.

13,793. Do any medical men object to their coming?—No.

13,794. (*Professor Way.*) When men get wounds on their hands is there any tendency in the wounds to run into inflammation?—No; I have not seen anything of that sort.

13,795. Do wounds heal pretty quickly?—Yes.

13,796. (*Chairman.*) Have you any steam-engines upon your premises?—We have not at present, but we are going to have one. We have one ordered now.

13,797. What is it for?—For exhausting the gas.

13,798. Are you going to get up steam by the spare heat from the retort flues?—No.

13,799. Do you not think that you could do so?—I think that it is possible. But there is this objection to it; we have three different retort houses, and we have not always the same at work, so that we must have a provision for firing.

13,800. Have you more than one chimney?—We have two chimnies.

13,801. What do you get a ton for your coke?—*8s. 4d.*

13,802. Do you find a ready sale for it?—Yes.

13,803. Do you buy any coal for firing the retorts?—No.

13,804. How much of the coke can you sell?—About 6½ cwt. for every ton carbonized.

13,805. How much do you use, and how much have you left for sale?—We make about 13 cwt. of coke per ton. We use about half, and sell about half.

13,806. About half the quantity which you have is sufficient to work your retorts?—Yes.

13,807. Then you have about half for sale?—Yes.

13,808. After you have roasted the gas out?—Yes. If we had our retorts as they have in London and other places, where they have a great number of retorts set in one furnace, we should have a greater quantity of coke to sell, but that would not be suitable for our requirements.

13,809. Is not the heat, when it passes into your chimney flue, very intense?—Yes.

13,810. Have you ever tried to make the heat serve for more than one set of retorts?—I believe that it has been tried.

13,811. Did it answer?—I am not quite positive whether they have it in some of the works in London; but I know that it has been tried. I have drawings at home of that system of setting.

13,812. By a double arrangement?—Yes.

13,813. In order to get as much out of the coke as could be got?—Yes.

13,814. Is there a sewer outlet in front of your gasworks?—Yes.

13,815. Does it form any deposit there, or is it affected by the deposit in the bed of the river?—It is affected by the deposit in the bed of the river. Sometimes we have to clear out the rubbish which has been brought down by the stream in order to keep it from backing up the drain.

13,816. The bed of the stream occasionally rises so high that it causes the water to back up?—Yes, higher up in the drain than our premises.

13,817. And to the inconvenience of owners of property?—Yes.

13,818. Do you think that that is in consequence of the bed of the river having been raised from time to time?—Yes, I believe so. At the time of the flood there was a drain on the opposite side which had got completely racked up with the waters, and it caused great inconvenience to some houses opposite our works.

13,819. Do you know to what height the water rose during the last flood, measuring from the low-water level of the beck up to the highest flood line?—I should say about five or six feet, perhaps five feet.

13,820. You did not measure it?—No.

The witness withdrew.

Mr. JOHN SHARP (Keighley) examined.

Mr. J. Sharp.

13,821. (*Chairman.*) You are the surveyor to the local board?—Yes.

13,822. You were previously surveyor to the commissioners, were you not?—There was a board of sewers for the town and parish, and I was their surveyor.

13,823. And you have been surveyor to the board of health since then?—Yes.

13,824. How long have you known Keighley?—40 years, and more.

13,825. How long have you acted as surveyor?—I have acted since 1840.

13,826. Were you a surveyor previously?—No, I started in 1840.

13,827. In what state are the rivers and becks now as compared with what they were when you first knew them?—The beds of the becks are raised considerably higher.

13,828. By what have they been raised?—By engine ashes and other rubbish which have been turned into the beck.

13,829. Have you, as surveyor, ever carted any road refuse in?—Yes.

13,830. How long since?—About a year since, or rather over.

13,831. Have you ever seen foundation material carted in?—Yes, a great deal.

13,832. How much do you think that the bed of the beck has been raised?—I can scarcely tell, but I should think 4 feet.

13,833. Has it blocked any of the drains in the town?—Yes.

13,834. It has back-watered them?—Yes. One at Low Bridge, two at Greengate, one in the South Beck, and another in the North Beck.

13,835. Have people complained to you, as surveyor, of those drains being back-watered?—Yes. We made a temporary drain down the beck side, and I think the people have not complained so much since that has been made, but they have complained several times lately.

13,836. Did the last flood back-water any drains?—Yes.

13,837. Which of them?—Along Longcroft, and it back-watered the one at Greengate; but there are not so many dwellings there.

KEIGHLEY.

Mr. J. Sharp.

27 Nov. 1866.

13,838. Have the people ceased to throw in their solid refuse since the board issued their notice?—Partially.

13,839. Do some of them do it yet?—Yes.

13,840. Have you, as surveyor, any power to report them, or to stop them?—Yes.

13,841. Do you do so if you see any person throwing in solids?—When I have seen them do it I have reported them to the board.

13,842. What do the board do if the parties do not give over that practice?—They take action and summon them before the magistrates.

13,843. And what do the magistrates do?—They seem to say that they have no jurisdiction.

13,844. You had a case before the magistrates recently, had you not?—Yes.

13,845. You, on behalf of the board, were the plaintiff?—Yes.

13,846. And you lost your case?—Yes.

13,847. Is that the case which was mentioned by the clerk to the board?—Yes.

13,848. Have you carried out any sewerage since you have been surveyor to the board?—Yes.

13,849. What sewers have you made?—We are now bringing up one from Stockbridge, and we have made one up Brunswick Street. I can scarcely tell you the number.

13,850. Of what size are they?—The one which we are now bringing up is a yard in diameter, and a yard high; 2 feet wide at the top, and 16 inches at the bottom, and covered with flat covers,

13,851. Do any of them ever press in at the sides?—Never.

13,852. What do they cost per yard?—They vary, some cost about 2*l.* a rood and some cost about 12*s.* a yard.

13,853. Are seven yards a rood?—Yes.

13,854. Have you any man-holes in your sewers?—Yes, every 20 yards.

13,855. And can you get easily to them from the surface of the road?—Yes.

13,856. You cover them with a flag and brick over?—Yes.

13,857. Do you not think that it would be better if you covered with a moveable cover, which could be removed easily?—Yes.

13,858. Have you any ventilation to your sewers?—Only by the gullies at the street side.

13,859. Are they not trapped?—No.

13,860. Are stinks complained of from them?—They have been occasionally complained of, but there is a very large flush of water.

13,861. Do the down spouts from the houses go into the drains?—No.

13,862. Do the down spouts deliver the water on to the pavement?—No, into the causeway.

13,863. And into the drain?—Yes.

13,864. Might they not act as ventilators?—Yes, partially.

13,865. Do you not think that it would be much better if your sewers were ventilated?—Yes.

13,866. (*Mr. Harrison.*) Are the houses generally connected with these sewers which you have put in?—Yes, generally.

13,867. What passes at present from the houses into the sewers?—Only their slops.

13,868. Are there many waterclosets in the town? Not very many.

13,869. How many?—I do not know exactly, but the board have always set themselves against waterclosets; they have not granted them.

13,870. Are there ashpits generally in the town?—Yes.

13,871. What becomes of the refuse from these ashpits?—It is taken by the farmers in the neighbourhood.

13,872. Ashpits are general throughout the town?—Yes.

13,873. Are they generally placed at some little distance from the houses?—Generally, but some are near.

13,874. Do you find those which are near objectionable?—Yes, they are rather objectionable, being so very near.

13,875. Are they mischievous to the health of the people?—We think so.

13,876. Do you and the board cause them to be removed when they are so?—We cause them to be removed when they become a nuisance.

13,877. Do you sewer much into the North Beck?—Yes, a good many sewers go into the North Beck.

13,878. So that you make the North Beck a kind of main sewer?—Yes.

13,879. Do you think that that is a good plan?—No.

13,880. Are many houses situated upon the North Beck?—Yes.

13,881. What is the effect upon the health of the people residing close to the beck?—I should consider the effect very injurious in some parts.

13,882. Have you known ill health arise from that cause?—Yes.

13,883. Are you taking any measures to remedy that mischief?—We are bringing up this main sewers I do not know how far the board have extended it but it is intended partially to remedy that evil.

13,884. Is the whole of the town sewered?—No.

13,885. What becomes of the water from the sinks, in the parts of the town where there are no sewers?—It is forced to lie upon the surface of the ground.

13,886. Does that give rise to bad smells and exhalations?—Yes; where the slops lie upon the surface; but generally the town is pretty well sewered.

13,887. (*Chairman.*) Has there been any general plan made for draining the town?—There has been a survey but not a general survey for the whole district.

13,888. Do you know Mr. Isaac Booth?—Yes.

13,889. Is he not acting for the board as consulting engineer?—Yes.

13,890. He has been advising you—Yes.

13,891. And you have gone over the district with him?—Yes.

13,892. Is there anything which you wish to add to your evidence?—I find that I have gone rather too far in my statement of the deficiency of drainage. There are a few short streets on the north side of the town which are not yet completely paved, and the board have given the parties notice to pave them.

13,893. It is merely a few short streets which are not paved?—Yes, but they are drained.

13,894. How soon are you going to pave them?—I do not know, I have received orders to pave Cavendish Street.

The witness withdrew.

Mr. H. Emmott.

Mr. Holmes Emmott (Keighley) examined.

13,895. (*Mr. Harrison.*) How many years have you resided in Keighley?—41.

13,896. How many years have you been inspector of nuisances?—11 months.

13,897. Do you remember the state of the streams here formerly?—Yes, very well.

13,898. How were they 40 years ago as compared with what they are now?—40 years ago I cannot tell much about, but 35 years ago they were lower from four to five feet than they are now, speaking of the North Beck.

13,899. How do you know that?—I know it by some property which goes alongside of the North Beck.

13,900. Are you interested in that property?—No, but I went to school there, which makes me know all about it, and we used to play in the beck, and I see that is has risen something like four feet at those old

buildings, which are now standing on the side of the beck. We used to go down two steps into the beck.

13,901. Do the builders in the town throw rubbish into the beck?—They do not now; they have done so.

13,902. What sort of rubbish was it?—What they excavated from cellars, foundations, and so on.

13,903. Was there much stone about it?—Yes.

13,904. Solid, hard matter which would not be easily washed away?—Yes, mostly gravel.

13,905. Have you ever examined the material now forming the bed of the river?—Not lately. I have not examined it since this flood.

13,906. What would it be two feet below the surface of the bed?—Stone, sand, gravel, and engine ashes.

13,907. You would find them all mixed together?—Yes.

13,908. Imbedded one into the other?—Yes.

13,909. So that, if persons told us that engine ashes did not harm the river much because they would be light, and would be washed clear down to the sea, that would not agree with your observation?—No, because one gets bedded into the other, and so solid matter is formed.

13,910. Can you give the number and the description of the mills and manufactories on the banks of the stream at Keighley?—Upon the North Beck I believe, that there are about six worsted mills, one paper mill, and one corn mill.

13,911. What sort of refuse do they throw in?—They used to throw in their engine ashes, till lately; they have not done so lately.

13,912. Is there any polluted water of any sort?—They turn in the water which they have used for their dyeing purposes.

13,913. Is that all that they throw in?—Yes.

13,914. Do they thrown in soapsuds and things of that sort?—Not now, they used to do so; they send them to Messrs. Teale, Le Paige, and Co.

13,915. Where do they get their supply of water?—From the beck.

13,916. For their boilers?—Yes.

13,917. And for cleansing wool?—Yes.

13,918. Is it clean enough for their purpose?—It is not at all times clean enough for what we call scouring wool, or washing it.

13,919. At these mills is there much human ordure thrown into the river?—No.

13,920. How do they manage generally about that refuse?—They generally have tanks, and mix the ordure up with soil.

13,921. And they then send it out on to the land?—Yes, for agricultural purposes. There are one or two parties, I believe, who turn it into the beck.

13,922. Are there many underground cellars in the town of Keighley?—Yes.

13,923. Do you find that in floods, like what you had a fortnight ago, the water is back-watered into these cellars?—Yes, and into the houses too.

13,924. What is the character of the water which is so back-watered into the houses and cellars?—It is muddy.

13,925. There is a smell?—Yes, very bad. I went into several places after the water had subsided.

13,926. Does the smell remain some time after the water has receded?—Yes.

13,927. Does it cause ill-health to the inhabitants?—I suppose so.

13,928. But you do not know?—No.

13,929. Have the people called your attention to that nuisance?—Yes.

13,930. What steps have you taken?—I have told them to get it cleared away as soon as possible.

13,931. Have you assisted them to do so?—No.

13,932. Have you reported to you board that steps might be taken to remedy the matter permanently?—I have not had the means of doing so since the flood but perhaps I shall do so.

13,933. Are many of those cellars inhabited by poor people? Yes.

13,934. Were they driven out the other day when the flood occurred?—Yes.

13,935. What became of them?—They had to go into their neighbour's houses.

13,936. How long will it be before those dwellings are inhabitable again?—They have to be cleaned out and whitewashed.

13,937. Were they full of water?—There was six feet of water in them I believe.

13,938. The same nasty sort of water?—Yes.

13,939. Do you think that those houses can be fit for human beings to live in at present?—I do not think that they are, but the people have gone back to them.

13,940. Should not you think that that would be a cause of sickness in the town?—Of course it would.

13,941. Are many of these low parts of the town let out for lodgings?—No.

13,942. Have you a common lodging house in the town of Keighley?—We have nine registered lodging houses.

13,943. Have you any lodging house belonging to the commissioners?—No.

13,944. (*Chairman.*) In what part of the town have you most disease?—In the upper end.

13,945. What do you call it?—Westgate.

13,946. Are there many pigstyes in the town?—Yes.

13,947. Have you power to remove them or cause them to be removed if they are a nuisance?—Yes.

13,948. Have you given notice for the removal of any of those pigstyes?—I have given notice for the closing of several of them, and I have told the parties to keep them clean or that we shall remove them.

13,949. Have you many ashpits and privies close to dwelling houses?—Yes.

13,950. Have you had to complain of any of them?—Yes.

13,951. Have you had to give notice to cleanse them?—Yes.

13,952. Do you think that they ever are cleansed?—Yes, I see that they are.

13,953. Do you think that they do not stink as badly when they are empty as when they are full?—I hardly think that they will.

13,954. They are not sweet when they are empty, are they?—No, they are not.

13,955. When you empty one of those styes it is not actually cleansing it?—No; we now use perchloride of lime.

13,956. How many men have you under you?—Three.

13,957. They are working under your orders?—Yes.

13,958. Do you look after the sweeping of the surface of the roads?—Yes, for paving.

13,959. If you find that cottage walls are dirty have you power to order them to be limewashed?—Yes.

13,960. And if a room is not ventilated, can you order that ventilation should be put in?—Yes.

13,961. Have you done so in the last twelve months?—Yes, and it has been attended to.

13,962. Do you think that that has had any beneficial effect?—Of course it has. I have paid house to house visits in the lower class of houses.

13,963. Are the people offended when you visit them?—They were rather so, but they do not seem to be offended now. When I tell them from what the evil arises, namely, from having dirty houses, they seem to be very glad to remedy it.

13,964. Where do you get water for watering the streets?—From the North Beck and from the river Worth.

13,965. Do you get no water from the waterworks for watering the streets?—No.

13,966. Are most of the houses supplied with water?—Yes.

13,967. Do any of the people there use water from the beck?—No, I do not think that they do except for washing; two or three do that I believe.

13,968. How many houses do you think were flooded by the last flood?—Perhaps a score.

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13,969. Did it injure any of the furniture of these poor people?—Yes.

13,970. And have they to suffer that loss themselves?—Yes, I suppose that they will.

13,971. Did it injure any manufactories?—Yes.

13,972. Is there a manure yard anywhere near the town, where ashes are carted to, when they do not go into the country for sale?—No, we have not a depôt for the ashes; we have for the sweepings.

13,973. Have the poor people to pay for taking their ashes out, or do they get paid by the farmers?—They used to get paid by the farmers, but now we can scarcely get farmers to take ashes away. I suppose that it will end in our having to have a depôt.

13,974. Do you not think that it will end in the board having to do the work themselves?—Yes, I think that that will be the remedy. We could get the matter in the best order if it was in that way.

The witness withdrew.

Mr. W. Burr.

Mr. William Burr (Keighley) further examined.

13,975. (*Chairman.*) Do you wish to make an additional statement to the Commissioners?—The surveyor stated, and stated correctly, that some streets were unpaved and undrained; he was referring to the street which is named Cavendish Street, but I wish it to be understood that that is a street which is not yet formed, it is not half built yet; it was only commenced about two years ago, and the proprietors of the land themselves applied to the board to put the powers into operation and to drain it and pave it at once, and not to wait until the street was finished. I wish to explain that in order to show that even in that one street the proprietors of the land were anxious that proper drains and pavement should be put in, and if there is any fault at all it is the fault of our surveyor in not having done it already.

13,976. Have you availed yourselves of your borrowing powers?—Not at all.

13,977. But you know that you can borrow for the formation of streets for 5, 10, 15, or 20 years?—Yes.

13,978. And that you can take back the money from the owners of the land?—Yes; that subject has been discussed, but, as I have already stated, our board is a very careful board, and they have hitherto refused to put those borrowing powers into operation, but they must put them into operation now.

13,972. Do not you see that the system which has been hitherto adopted is anything but economy. In the streets to which I am alluding a pair of wheels can hardly go along, and if you go on in that way through the winter the probability is that vehicles will not be able to go along them, and then if the poor creatures who live there can get their coals at all the coals must be tipped at the end of the streets and be carried to the houses by hand?—Yes.

13,980. Do you know that in Lancashire during the cotton famine nearly 400 miles of that sort of street were paved?—Yes.

(*Mr. Sharp.*) We cannot get the material to do it.

The witness withdrew.

Adjourned to to-morrow at 11 o'clock.

Keighley, Wednesday, 28th November 1866.

Present:

ROBERT RAWLINSON, Esq., C.B., in the Chair.

John Thornhill Harrison, Esq. | Professor John Thomas Way.

Mr. J. Brigg.

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Mr. John Brigg (Keighley) examined.

13,981. (*Chairman.*) Are you resident near Keighley?—Within a mile of the town.

13,982. Are you chairman of the bench of magistrates of this district?—Yes, I have been so for about 15 years.

13,983. How long have you known Keighley?—From infancy.

13,984. Have you been at all engaged in business?—Yes, I have been engaged in worsted spinning and in the manufacture of wool.

13,985. Are you still engaged in that business?—Yes, nominally so, but I have a partner.

13,986. Where are your works situated?—In West Lane, half a mile from this place, above the town.

13,987. Do you use water-power or steam-power?—I have two mills; one is about half a mile from the town, and there I employ steam-power entirely; and I have another two miles off above, on the stream, on the Laycock Beck.

13,988. Is that a branch?—I do not know exactly what you would call it.

13,989. Does it fall into the North Beck?—Yes, it will be the North Beck.

13,990. Do you use steam-power?—At the mill near the town I use steam-power, and the one which is two miles from this place on the bank of the North Beck is worked by a water-wheel.

13,991. Of what power is it?—About 20-horse.

13,992. Have you water at all times in the year sufficient to work your power?—No.

13,993. How long do you stand still in a dry year on an average, take last year for instance?—Last year perhaps we should have lost 60 hours during the summer months.

13,994. Is not that very small?—We have lost as much as 100 or 150 in some years.

13,995. Do you work all the time?—By the Factory Act any loss of time that arises from short water, where there is solely a water wheel, may be regained by one hour each day.

13,996. That enables you to calculate the loss by hours?—Yes; a return of that kind is made to the factory inspectors.

13,997. How long has the mill which is in your possession been worked by water-power?—It was worked by water-power before I was born. I cannot tell, but 60 years ago.

13,998. Has there been any material alteration in the character of that power since you can recollect it, or is it as good now as it was when it was first commenced?—It is much better, owing to the reservoir that we made on the moor 28 years ago.

13,999. Has the channel leading to the wheel been choked up by wreck washed down from the moor?—No.

14,000. Has the tail-goit been impeded by floods?—Yes, occasionally by wreck which has been brought down by floods, as on Friday week last; we had more wreck accumulated in the goit then than we had had for seven years; it threw us into back water.

14,001. Have you to remove that by hand?—Yes; it is too heavy to flush.

14,002. What will it cost you to clear the tail-goit after the last flood?—Perhaps from 5*l.* to 10*l.*

14,003. Are there any factories on that stream?—No, we are the highest.

14,003*a*. Is there any solid refuse thrown in above your mill?—I believe not, not the slightest.

14,004. Do the banks subside at times and wash in above you?—I do not think they do; the North Beck is exactly as wide as it was when I recollect it first.

14,005. How many hands do you employ at that mill?—I employ perhaps 40 there.

14,006. Do you dye or wash?—Neither.

14,007. Do you use water for any purpose in your manufactories?—All the water that we use there is for turning the water-wheel; I except what is used at a cottage on the premises for domestic purposes.

14,008. Have you any privy accommodation for the hands employed in that mill?—Yes, but not on the banks of the river.

14,009. Does any refuse pass into the river?—No.

14,010. You do not pollute the stream by that mill in any way?—No; the privies are on the opposite side of the building to the water; we contract with a farmer to take away the excrement.

14,011. Do the farmers pay, or do you pay them for taking it away?—It is a tenant of my own who takes it; I let him have the privilege of taking it away, but he takes it away at his own cost. When the refuse has accumulated in the troughs he is sent for and takes it away.

14,012. Do you think the floods are as heavy now as they were when you first knew the river?—Not at our mill, in consequence of the reservoir that we have made; that has altered the conditions of the stream all the way down.

14,013. What volume do you send out of that reservoir on each day?—That depends upon the quantity that we want.

14,014. Is that a reservoir that you made yourselves?—No; it is a reservoir that was made upon the Duke of Devonshire's property originally.

14,015. (*Mr. Harrison.*) Is that reservoir about five miles to the westward of Keighley?—Yes.

14,016. (*Chairman.*) Did the Duke of Devonshire make it for you or for his tenants?—Originally the duke advanced the money, but we paid a certain amount of rental for 14 years after that. I happened to see his grace, and he said to me, "Is it a good thing?" I said, "Yes." "Then," said his grace, "Would it not be a good thing to have another?" I suggested the propriety of enlarging the present one, as the bank was sufficiently strong, and his grace then sent an engineer to examine it. He considered that it might be safely raised six feet higher. We rented it first for 14 years and then for 10. Four years have now gone in a 21 years' lease. I hold in my hand an extract from a report by Mr. James G. Lynde, junior, upon the Keighley reservoir, December 28th, 1853, which was sent to the agent of the Duke of Devonshire in London, William Curry, Esquire. It is in these terms:—

"During eight months of the year there would be a "deficiency of water at the mills without the reservoir "of 238 cubic feet per minute for ten hours a day. "The surplus water during ten hours a day for the "remaining four months is equal to 14,063,184 cubic "feet. The drainage area belonging to the reservoir "is 445 acres, and the average flow of water per acre "due to a depth of 18 inches rainfall is 124 cubic "feet per minute, which would give an average flow "into the reservoir during the year of 55·18 cubic feet "per minute. The reservoirs or dams attached to "the several mills are capable of storing about "one and a half hour's supply. This added to the "10 hours work gives 11½ hours for each day during "which the millers can availably use the whole "stream. During the remainder of the 24 hours, "which will be 12½ hours, the water may be stored "beneficially. At the rate of 55·18 cubic feet per "minute, 15,104,525 cubic feet can be stored per "annum at the level of the present reservoir. "Between the reservoir and the highest mill on the "stream there is a large drainage area, for which a "storage reservoir might with advantage be con-"structed, but this does not affect the present ques-"tion. I estimate the contents of the existing "reservoir at 5,749,920 cubic feet, and it is capable "of affording a supply of 138 cubic feet per minute "for ten hours a day during eight months of the "year. The value of this to each mill will be pro-"portioned to the heights of the falls, which, as near "as I can learn, without making an actual survey, "are as follows:—

Name of the mill.	Height of fall.	Horse-power.	Annual value.
	ft. in.		£ s.
Goose Eye Mill	30 9	4	32 0
Turkey Paper	29 0	$3\frac{4}{5}$	30 8
Wood Mill	21 0	$2\frac{7}{10}$	21 12
Holme Mill	21 4	$2\frac{4}{5}$	22 8
Hill Top Mill	9 0	$1\frac{1}{10}$	8 16
Castle Mill	23 3	3	24 0
North Beck Mill	24 0	$3\frac{1}{10}$	24 16
Becks Mill	14 8	2	16 0
Corn Mill	21 6	$2\frac{4}{5}$	22 8
Hattersley's Mill	3 10	$\frac{1}{2}$	4 0
Cabbage Mill	16 0	2	16 0
Low Mill	20 0	$2\frac{3}{5}$	20 16
Strong Close Mill	9 0	$1\frac{1}{10}$	8 16
Stubbing House Mill	14 0	$1\frac{4}{5}$	14 8
			£266 8

"This is in my opinion the most economical method "of increasing the powers of the mills, and so long "as there is any surplus water to be stored, it will "always be worth the while of the millowners to "construct additional reservoirs rather than resort "to steam power. To Wm. Curry, Esq." The above report supposes that the reservoir can contain all the water that falls, and that the reservoir is emptied $2\frac{2}{3}$ times every year, which is not the case, as is seen by the water which passes by when the reservoir is full.

14,017. The paper which you have read contains a tabulated list of the names of the mills, height of falls, horse power, and annual value. Is it the estimated value, or is it the actual rental that is paid?—The rental is 112*l*.

14,018. What is the annual value that is put down?—I do not know. That is Mr. Lynde's estimate. It is all in Mr. Lynde's report.

14,019. The estimated value in the paper you have read is 266*l*. 8*s*. 0*d*.?—Yes, according to Mr. Lynde's estimate.

14,020. And how much do you pay?—112*l*. is paid upon 12 mills. It would have been 120*l*., but two mills have ceased to use the water. That shows the actual value paid now. There are, as I have said, about 12 contributors at the present time. Since this report was made another mill has been built on the stream, and that pays 2*l*. a year for taking water out of the beck for engine purposes. Those 12 mills now pay 112*l*. and a few shillings. That is the rental paid to the Duke of Devonshire.

14,021. It is a rental paid for the water that is turned down that stream?—Yes, the water is impounded, and we have the advantage of it.

14,022. Is it a rental for the land upon which the premises stand?—The reservoir occupies, I believe, 20 acres, and is built on land belonging to the Duke of Devonshire.

14,023. Does the rental paid for the water include any rental for land used at the mills?—No, not at the mills.

14,024. It is simply for the water?—Yes.

14,025. What is the depth of the bank?—I cannot say.

14,026. With regard to the mill near to the town, do you use water or steam power there?—Steam power exclusively.

14,027. What do you manufacture there?—Worsted yarns and manufactured goods. Various textile fabrics.

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14,028. What number of hands do you employ?—Perhaps 600.

14,029. What weight of coal do you burn per annum there?—About 36 tons a week.

14,030. What do you do with the ashes?—We contract with the Midland Railway Company to take them all; we send them.

14,031. Do you at any time throw the ashes into the beck?—No, we are too far away.

14,032. Which is the stream nearest to you?—The North Beck.

14,033. Do you take water from that beck for engine purposes?—No, we get water from natural springs in my own ground.

14,034. Do you use water for washing wool and dyeing?—Not for dyeing.

14,035. What sized pump do you use?—I cannot state exactly.

14,036. Do you get all that water from springs on your own premises?—Yes.

14,037. Does it go away from your premises polluted?—Only so far as it has gone through the boilers, nothing more. We have a reservoir at the lower mill to store spring water for the use of the engines. The stream is not sufficient without storage, the overflow from the reservoirs goes through my own lands into the beck.

14,038. Do you ever cleanse those reservoirs out?—No.

14,039. Do they never get silted up?—No, we have never had them so.

14,040. What arrangement for privy accommodation have you made for the hands employed at that mill?—We have I do not know how many privies, not exactly common privies, because they have seats. They are more in the shape of waterclosets. The sewage is conveyed in iron pipes to one point, and there we have a strong waggon, made on purpose, which runs underneath and receives the contents of six or eight privies.

14,041. The refuse is carted away to the land?—Yes, and we have a similar arrangement also in the sheds.

14,042. Do you mean the weaving sheds?—Yes, and in all cases there is not the slightest loss or leakage from the privies, as we have wooden waggons sufficiently tight and strong to retain the whole of the liquid until they get full. Once a fortnight the sewage is all carted away on to our own land and laid up for manure, which we consider very valuable.

14,043. You have it taken on to your own land, and you consider it is beneficial for agricultural purposes?—Yes.

14,044. You find that it pays you for the cost and trouble you have incurred?—Yes, it costs us a good deal, but that is nothing in comparison with the accommodation afforded by the privies, and the advantage we derive from applying it to our own land.

14,045. Do you use wool exclusively in your operations at that mill?—As far as spinning is concerned we use wool exclusively, but in the manufacture of textile fabrics we use silk and cotton.

14,046. Any shoddy?—No.

14,047. Is any shoddy used with the wool?—No, I think not. I am not aware that any is used on this side of Bingley.

14,048. What engine power do you use at the lower mill?—The estimated power is 50-horse, but it actually works up to 80-horse power.

14,049. That is by the pressure of steam and the method of working it?—Yes.

14,050. Can you state the nominal horse power?—110, but we work the engines to do more than that.

14,051. Have you considered the question whether your steam power is as economical as your water power?—Water power is much more economical where we can have a continuous flow of water.

14,052. You work on steadily, and you prefer water-power under those circumstances?—Decidedly.

14,053. Is water power as good and as steady for the machinery?—Equally so, for both water power and the steam engine are regulated by a governor.

14,054. If you could obtain all your power from water, you would prefer water to steam?—Yes, but it is necessary to take into consideration that situation makes some difference. If at the place where my steam power works are I could have water, it would be a very great advantage. But steam power on a convenient site might be better than water power at a place in the country four or five miles away from the town, with bad roads.

14,055. If you had all the goods to cart to and from the upper mill you must take into account the situation?—Yes, and the distance from a railway.

14,056. In what condition do you find the rivers and becks in and about this district, as compared with their condition when you first knew them; have the beds been raised by floods?—The beds of the becks near the town have been raised by accumulations.

14,057. Of what kind?—The principal part of the accumulations in the beck originally came from digging out cellars, foundations from houses were so disposed of; but as manufactories increased, and steam power increased, a very large quantity of engine ashes was produced; those engine ashes, generally speaking, found their way into the beck. Some parties would purchase land with a fall a short distance from the beck, or immediately on it, and would deposit their ashes there to be carried away when a flood came.

14,058. They considered the beck the proper place to take their ashes to from their premises?—Yes, and no attempt was made to prevent it until in recent years.

14,059. The parties considered it an advantage to be in a position where they could so dispose of their ashes?—Yes, but that was some time ago; more recently they have not been doing so.

14,060. At the present time do any parties within your knowledge put their ashes into the beck?—I believe that nobody does it now, but I do not think I am a good authority for that.

14,061. Have you any jurisdiction over streams or becks to prevent that pollution, or have any cases been brought before you?—Yes.

14,062. Have you power to interfere?—Yes, under the Local Government Act we have. A case occurred not long ago, and an appeal was made to the Court of Queen's Bench against our decision. The decision come to by the magistrates was reversed.

14,063. Have any complaints been made with regard to the becks outside the district under the local board?—I do not remember one, a great many of the mills in the district are within the borough.

14,064. In the event of the legislature passing any measure to prevent this abuse and pollution of streams, does your experience enable you to give us any opinion as to whether or not it would come within the range of your duties to prevent pollutions by means of the police?—Yes, I think it might.

14,065. How far does your jurisdiction extend?—Over the whole area, within a radius of six miles from this place. It is rather a division of a wapentake, it was formed when I was put on the commission of the peace.

14,066. For what purpose was that circle so laid down?—Simply for the convenience of the public, we take a certain portion of the wapentake.

14,067. Are all your decisions given in that district subject to revision by a larger section of the magistracy of the riding?—In cases of felony etc., the petty sessional magistrates cannot imprison, but the prisoners are sent to the quarter sessions, and then are tried before a jury. We are one division out of 25 divisions in the West Riding of Yorkshire, and we have over 50,000 inhabitants.

14,068. Do you use soap in your manufactures to any extent?—We use a washing material. We wash the wool, but we use very little of what is commonly known as soap.

14,069. What do you use?—We use oil and alkalies as a substitute for soap.

14,070. What weight do you use of those materials in a week?—We use a ton per week; after the washing has been done the liquid is filtered and the solid part thrown down.

14,071. By Teall's process?—I do not know exactly who the patentee is. We are paid according to the number of packs of soap consumed. The lessees have a reservoir where the waste liquid is impounded.

14,072. Do you know what number of packs of soap you use in a week?—We use I believe a ton of soap.

14,073. What sum do you receive for the recovered material?—I think it is about 4*s.* 6*d.* for each pack consumed and a pack means 240 lbs.

14,074. You are put to no cost?—No.

14,075. Have you to find room for the tanks on your premises?—Yes, the liquid is impounded there. They purify it, and then they cart the scum that rises to the surface away from our works. They take it down to the works where they take all the refuse, and I suppose the works are just below this town, near the railway station.

14,076. How long has this operation been carried on of extracting this material from soap waste?—In this district for perhaps seven or ten years.

14,077. Do all manufacturers who use soap save the refuse soapsuds and have them treated in a similar way?—I suppose they do, because it costs them nothing.

14,078. Do you know what income it produces you per annum?—No, I do not.

14,079. (*Professor Way.*) 120*l.* or 130*l.* a year?—I should say 130*l.* a year.

14,080. (*Chairman.*) They take away what they like and leave what they like?—They take away all the solid matter, and put the suds into a large cistern; after the suds have stood a certain time they put in a quantity of acid, which brings on to the surface perhaps three or four inches of thick greasy matter, that is put into a cart and taken away, and passed through some process which I do not understand.

14,081. What is done with the waste water?—It runs down through the land, and eventually gets into the beck.

14,082. Does it pass on to the land for irrigation purposes?—Yes.

14,083–4. And helps to grow grass?—Yes, a certain amount of sediment lodges in the open drain.

14,085. Do you attempt to put the waste liquid over the surface of the land to irrigate it?—One of our men does it regularly.

14,086. He irrigates his grass land with it?—Yes, he diverts the sud-refuse out of the watercourse.

14,087. (*Mr. Harrison.*) After an acid has been used?—Yes.

14,088. (*Chairman.*) You get out the solids and use that for manure?—Yes; there is a certain amount of sediment that lodges in the drain as it runs down, after the greasy matter has been taken from it; that drain is opened and cleaned out, and then the sediment is thrown on to the land; in other cases one of our men diverts the water over his land and spreads it over the land.

14,089. And it does not injure it?—No; he continues to do it, so I suppose it does not.

14,090. (*Mr. Harrison.*) By the time the water is discharged into the river is it purified?—It is not perfectly clear, it is a little discoloured; but it has nothing like the appearance of the suds that come from the washing machine.

14,091. (*Professor Way.*) You stated that you did not buy any soap; are the articles that you spoke of, viz., grease and alkali, boiled in a copper at your works?—Yes.

14,092. Then you make soap, you do not buy it?—Yes.

14,093. (*Chairman.*) During the last flood did you sustain any injury?—Yes, a little at the water-mill.

14,094. Was any injury done at your lower mill?—Not at all; we are quite above these floods.

14,095. Did you notice the condition of the valley of the Aire; was much injury done by the flood in the valley below you?—I live to the west, and I went on to the hill, and I saw the valley all covered with water; at least there was a large quantity of water looking like a sea. On the day following I rode down a road which had been covered by the flood; the water had washed walls down, which it had not done for many years before; but I have seen that done many times when there has been a higher flood on that road. I think there was more water in the river this time than before; and the reason was, that in taking the Stockbridge dam stones down they had reduced the level of the water under the bridge 5 feet, and consequently caused more water to go down the Aire.

14,096. Do you think that this last flood was as large a flood as you can ever recollect?—Yes, it was in volume of water, but it did not cross the road so much as I have seen a flood do, and the reason of that was the removal of the dam stones at Stockbridge about a year ago.

14,097. (*Mr. Harrison.*) Is there much water-power in Keighley?—Not very much; there are three or four water-wheels, but not many; the larger proportion of the propelling power is steam.

14,098. It was stated yesterday in evidence that the bed of the Worth had been raised four or five feet within the memory of inhabitants?—Yes, it has been considerably raised, but I have not noticed it myself. I have not sustained any injury by it.

14,099. Do you know whether the water-power at Keighley has been much injured by the filling up of the bed of the Worth?—Yes, as in the case of what is called Cabbage Mill. The accumulations were allowed to go on in the Worth there until they actually raised the bed of the river so high that the water could not empty itself out of the goit from the water-wheel, and that water-wheel is standing still to this day.

14,100. What power might they have had formerly at that mill?—I have no idea. At another place they made a weir down the centre of the beck, and of course that has preserved them a good deal; the tail-goit is open, and when there is a flood it overflows it; when there is a moderate flood the tail-goit empties itself two feet lower than the bed of the river.

14,101. Have you observed whether the water which passes through the town appears in a dry season to be diminished in consequence of the filling up of the bed?—I have not. I think that the accumulations in the stream have not yet diverted the stream from its natural course. I am not aware of any instance of that kind.

14,102. What do you consider in the neighbourhood of Keighley is the relative value of water-power and steam-power?—Where there is a full supply of water water-power is equal in value to steam-power of the same horse-power; but there are very few instances where that is so. Water-power would not let for so much, because there is the danger of short water, and upon the whole a man would not trust to water-power as being as regular as steam-power.

14,103. If you were taking a mill, at what would you put the relative value?—I have no idea; but perhaps 15*l.* per horse-power.

14,104. How much would you set down for water-power?—If it could be as constant as steam it would be of the same value, but it is not. Its value depends entirely upon what water they do get, consequently it is a matter of speculation.

14,105. What do you reckon that your steam-power costs you in coal and interest on capital laid out on machinery and in repairs per annum?—I do not know what a steam-engine is considered to consist of; the first moving shaft is considered the freehold of the place; all the rest of the steam-engine is mechanical.

14,106. How would water-power be rated in this neighbourhood as compared with steam-power in determining the rateable value of the horse-power—by the shafting?—I cannot answer that question; but I

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believe that an estimate of so much per floor and so much per horse-power is made, and so the rateable value of the premises is ascertained.

14,107. Is there anything further that you wish to add?—There is a reservoir that has been alluded to; that reservoir has been made 28 years, and it has been inspected by Mr. Lynde. After the Holm Firth flood the Government sent down an inspector, and he went to Holm Firth to ascertain the cause of that disaster; from there he came to Keighley to examine this reservoir; he made a minute inspection of it, and said that it was most perfect and safe, that the foundation was upon a rocky material. There is a pitched front, with large rubble stones; the by-wash is 16 yards wide, and during the flood on Friday the water did not cover the whole of the by-wash; about 2 o'clock it ran over about 6 inches, and from 3 to 4 o'clock it ran over 9 inches; the top of the high-water level is 5 feet below the bank, the by-wash is 5 feet below the embankment itself, and upon that embankment is a 4-feet wall besides; a wave came and dashed the spray over the 5 feet, and threw it over on the other side; we put a wall there to prevent the spray going over, and after the flood I went to see, and not a stone was in the least moved.

14,108. Is the water drawn to the bottom of the bank out of an iron pipe, or out of a stone culvert?—An iron pipe. Suppose this was the inside of the bank (*describing*); formerly we had a pipe that came through the bank, and we let the water out at the low end; but that was not safe, as some of the joints might give way in the centre of the bank from the pressure of the water; we therefore drew the dam out and put a sluice or clough inside, so that we have no water in the pipes, excepting when we draw it; the clough is worked by large rods on the top of the bank, and now I have as much confidence in the security of that bank as I have in my own house.

The witness withdrew.

Mr. R. L. Hattersley.

Mr. Richard L. Hattersley (Keighley) examined.

14,109. (*Chairman.*) You are a member of a firm of machine makers?—Yes.

14,110. What machines do you make?—Principally power looms.

14,111. For the manufacture of woollens?—Worsted.

14,112. Where are your works situated?—On the North Beck.

14,113. Are they above or below the town?—Nearly in the centre of the town.

14,114. What area of ground do your works cover?—Perhaps 3,000 square yards.

14,115. What length of frontage on the beck have you?—Nearly 100 yards.

14,116. Do you own both sides of the beck?—The beck runs the whole length of the old premises, and partly underneath; then there is a road down the other side of the beck, and we have other buildings on the other side of the road.

14,117. Do you consider that that portion of the beck which flows through your premises belongs to you?—Yes.

14,118. Have you put any arches over it?—Yes, we have buildings over the beck.

14,119. Then it runs entirely under certain buildings?—Yes, entirely under buildings.

14,120. How long have your works been there?—Some portion of them have been there for 60 years, I think.

14,121. How long have you known the beck or the works?—I have never lived anywhere else. I have been in the place 32 years, and more than that.

14,122. Do you think that the bed of the beck has risen during that period of time?—Yes, opposite to our premises.

14,123. Have you tried to keep it down?—Not particularly, except in a time of flood; in the last flood we did not take any steps.

14,124. Have you at any time suffered from flooding?—No, I do not know that we have.

14,125. Did you suffer during the last flood?—I do not know that we did.

14,126. Do you use engine power?—Yes, exclusively.

14,127. What weight of coal do you burn per annum?—From 800 to 900 tons.

14,128. What do you do with the ashes?—We put them principally into the beck course, and we cart part of them away.

14,129. Do you put them principally into the beck?—Yes, not entirely.

14,130. Have you ever seen the notice issued by the Board of Health against that practice?—Yes.

14,131. Have you paid any attention to it?—Not much.

14,132. Supposing a restriction was put upon you, and you were told that you were not to put ashes into the beck any more, what would you do?—Our place is a very awkward place, and we have to lead the ashes to the land if we cart them away, therefore it is a great convenience to us to be able to put them into the beck; we do not make a very great quantity, I think about 6 cwt. a day.

14,133. Whether the quantity be large or small, if all persons were to be restrained from putting ashes into the rivers and streams, do you think you would escape?—Certainly not.

14,134. What would it cost you to take the ashes away a year?—It would cost 40*l.* or 50*l.* to cart away all the refuse that we make; what we make in the foundry we do not put into the beck at all.

14,135. Do you use water for any purpose but for the boilers?—Yes, we use water for turning the iron, that is, for grinding.

14,136. Not any large quantity, I suppose?—No.

14,137. You do not foul the water very much?—No.

14,138. Do you take water out of the beck and send it back again after you have used it?—Yes.

14,139. How many men do you employ?—About 250.

14,140. Have you any privy accommodation on the premises?—Yes.

14,141. Where does the refuse go?—Part of it goes into the beck, and part does not. Part goes on to the land; we cart it away every week or fortnight.

14,142. Do you think it would be difficult to keep all the privy refuse out of the beck?—Yes, because on the old premises we have no yard.

14,143. You occupy all the ground, do you?—Yes, and the refuse has gone into the beck ever since I knew it.

14,144. Have you seen or heard of the newly invented earth closets, which is an arrangement in the shape of a watercloset, only dry earth is used in place of water?—I have not seen them, unless I once saw one at Blackburn.

14,145. Supposing it was proved to you that without altering your privies you might introduce one of these contrivances and intercept all the solid refuse and take it away, should you consider it a great hardship to be compelled to do so?—No, I do not think it would be a hardship; we should not object.

14,146. Has the beck ever been filled in at all by refuse thrown in at any other point than opposite to your premises?—Just below our premises there is a dam stone and a mill, now given up, and I believe the beck course is wrecked up from this dam stone to the one below. I do not think the same is the case either above or below.

14,147. Did you hear the evidence that was given yesterday?—Yes.

14,148. Did you hear that some of the drains were choked up in consequence of the bed of the beck having been raised?—Yes, from 4 to 5 feet, in that part which the witness alluded to. There is a bridge

perhaps 200 or 300 yards below our place, and this morning we measured 4 feet 9 inches from the beck course to the under side of the crown of the arch. 15 years ago a flood carried away a boiler from the side of the stream, and it passed under that bridge with some difficulty, but that boiler was 6 feet 6 inches in diameter.

14,149. I suppose it could not go through now?—No, because there is only a space of 4 feet 9 inches; that is the average space; the bed has risen there. After the flood we could not see how the boiler had gone underneath, for it appeared larger than the space there was for it, but the boiler did go through, and it rested on the low side of the bridge.

14,150. Do you think that the boiler from blocking the archway up caused the water to scour out the beck, and so was forced through?—I think that the boiler ploughed its way under the bridge, and so went through.

14,151. (*Professor Way.*) The bed of the river would fill up afterwards, would it not, as the flood subsided?—Yes, but that was not so heavy a flood as the recent one, nothing like it.

14,152. Do you think that the floods are as heavy now as they were when you first knew the beck?—Yes, the last one has been as heavy as any I have seen.

14,153. Are you aware that many persons have had their cottages flooded?—No; a few below were flooded, two or three, just below the bridge.

14,154. And other premises?—Yes, the water came over the bridge there.

14,155. You have stated that it would cost you about 40*l.* or 50*l.* to cart away the ashes, would that be a very serious matter to you?—Only to that amount.

14,156. You say that you employ 250 men?—Yes.

14,157. May I put the expense at about 1*l.* a week?—Yes.

14,158. Then it would be about a penny per head of your men?—Yes.

14,159. It would be the same thing to you as if you raised the wages a penny per head to all of your workmen?—Yes, about that amount.

14,160. I suppose a sum like 40*l.* or 50*l.* is not very serious outlay for the benefit of the public?—No, it is not a very large expense. I do not believe that the filling up of the beck course where it has taken place is due to anything that millowners cast in at present. I do not think that there is a large amount of ashes in that part of the beck course which is filled up; I believe it consists principally of stones and gravel, and diggings of foundations.

14,161. Do you think that diggings from foundations should be allowed to pass in as heretofore?—Not if the beck course is not to be filled up.

14,162. If diggings from foundations do fill up the beck course, do you think that ashes have no tendency to do the same?—They must fill it up, certainly, but I believe that they are taken to a greater distance than the other refuse is.

14,163. Are you aware that the last flood has done an enormous amount of damage all the way down the valley?—I believe it has.

14,164. That it has flooded land and premises to an extent that has scarcely ever been remembered before?—Yes, I believe so.

14,165. And that to estimate the loss sustained along the valley, you must measure by scores of thousands of pounds?—Yes, I am aware of that.

14,166. Considering these things, that this town and all places above it—Todmorden, for instance—have thrown for the last half century thousands of tons of solid refuse into the streams, do you not think that the flood has come like a punishment upon them?—No.

14,167. Taking the broadest view of the case, should you say that it would be right for the Government to allow things to go on as they have been, and permit persons who may say that they would find a difficulty in doing otherwise to throw ashes and other refuse into the streams?—I do not think that ashes are much detrimental in this district; I do not see where they have caused much damage, if any.

14,168. (*Mr. Harrison.*) Have you been down the stream to see whether any damage had been done below?—Yes; I have been down the river Aire from this place, and I cannot see from my observation that the beck course has been filled up below the dam stone next but one below us.

14,169. Then you must go down to where the Aire and where the Calder are navigable?—I do not know much about the river Aire below.

14,170. (*Chairman.*) Assuming that beck courses are filled up by the wrack which is brought down by the floods and the gravel, do you think it is desirable that this state of things should be continued, and that it should be no person's duty to keep such matters out?—Certainly whatever fills up the river course below would do injury.

14,171. There is a beck course not many miles below Keighley, and it is clear that the bed of the beck is three or four feet above the level of the adjoining land?—I have not seen anything of that sort; there is nothing of that sort in our beck, but that is caused by engine ashes, and I do not know whose business it is to rectify that.

14,172. Would it not be a benefit to everybody if it was somebody's business to rectify that state of things?—Certainly I should think so.

14,173. Are you aware that a rough estimate has been made, showing that more money has been lost in one week by the flood than, if properly laid out, would have put the river into such a condition as to have prevented the evil effects of such a flood?—Yes, I have no doubt of it.

14,174. It is estimated that more than 50,000*l.* worth of damage has been done at Leeds?—I do not think, so far as we are concerned, that we shall object to do what we can to remedy the evils existing in our own district, but we do dislike to be the one party to be picked out and told not to do what other people are allowed to do.

14,175. If you were all put under the same regulation you think you would comply with it?—Decidedly.

14,176. You would then feel that you were not being punished exceptionally, or from party spite?—Certainly.

14,177. Is there anything further that you wish to add to your evidence?—I think not. We think that if the sewage was kept out of the watercourses in our district the water would be as pure as ever it was.

14,178. And you would be benefited to that extent?—Certainly; the smell of the flood that came down was not at all agreeable.

The witness withdrew.

Mr. Edward Townend (Cullingworth) examined.

Mr. E. Townend.

14,179. (*Chairman.*) Are you a worsted spinner?—Yes.

14,180. Where is your mill situated?—At Cullingworth, one of them.

14,181. On what stream?—The Cullingworth Beck.

14,182. Into what river does it fall?—It falls into the Harden Beck, and that falls into the river Aire.

14,183. How far are you in a right line across from the Aire?—Three miles.

14,184. Do you use steam power or water power?—I use both.

14,185. What amount of water power do you use?—We have four mills.

14,186. On that beck?—No, only one on the Cullingworth Beck.

14,187. Where are the other three?—One is on Ellar Carr Beck, which flows also into the Harden Beck

14,188. Have you any names for the mills?—Yes.

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14,189. Will you name one?—The largest one is Cullingworth Mill.

14,190. And the next?—The next is "The little mill" at Cullingworth.

14,191. What is the next?—The next is Woodfield Mill, and the next is Ellar Carr Mill.

14,192. What is the manufacture at the Cullingworth Mill?—Spinning and combing.

14,193. What number of hands do you employ?—We employ about 1,000 in that mill, or nearly so.

14,194. Do you employ engine power?—There is no water power at the Cullingworth Mill.

14,195. What weight of coal do you burn in a year?—At all the mills we burn (including what is required for the steam engines) about 120 tons of coal a week.

14,196. What business is carried on at the little mill?—Spinning, exclusively.

14,197. What is done at the Woodfield Mill?—Solely weaving.

14,198. And at Ellar Carr Mill?—Weaving only.

14,199. At which of the mills do you use water power?—At the Ellar Carr Mill we use partly water and partly steam power.

14,200. What amount of water power do you use?—It is rather irregular, but I think it is about 8-horse.

14,201. Are you on the Bradford Waterworks stream?—No.

14,202. Do you use soap at your mills?—At Cullingworth we do.

14,203. What number of hands do you employ altogether?—I should think about 1,200 altogether, but I cannot speak to within 50.

14,204. That is at the four mills?—Yes.

14,205. Are they all engaged in the worsted business?—Yes.

14,206. What privy accommodation have you for your hands?—There are separate privies at each mill, and the sewage is all taken out and mixed with ashes, which we collect from the cottages.

14,207. You do not pollute the stream?—Not at all by the privies.

14,208. Do you use much water for washing the worsted?—Yes, and we take it from a reservoir at Cullingworth Mill.

14,209. Of what area is that reservoir?—It is about 60 or 70 yards square.

14,210. Does it receive water from springs?—Yes, and from the drainage of the hills and the roads.

14,211. Is that sufficient for all your washing purposes?—Yes, except in extreme droughts. In the summers of 1864 and 1865 we were very nearly standing still at the works for want of water, and we were put to considerable expense for washing. We resorted to a spring which we had in a field near to the works, and we conveyed the water from that spring into the works through a pipe.

14,212. How much water do you use daily in the washing process?—I cannot tell.

14,213. What sized pipe does the water flow through?—It is a 6-inch pipe.

14,214. Does it get full?—No, half full; but the water is not continuously running.

14,215. What weight of soap, or an equivalent for soap, do you use for washing?—My evidence upon that point would be the same as Mr. Briggs'.

14,216. How many packs do you use in a week?—About 12 packs.

14,217. Is the grease afterwards extracted?—Yes.

14,218. Is that done by yourselves, or do you lease it?—By ourselves. It is treated on Messrs. Teall's system.

14,219. (*Professor Way.*) Do you pay a royalty to them?—No.

14,220. Is it treated by heat at all?—Yes. I should mention that in the first instance we let our suds to Messrs. Teall for several years, and then they gave it up, and we took to it ourselves.

14,221. You carry out the process up to the point of squeezing out the grease?—Yes.

14,222. Do you sell the grease?—Yes.

14,223. To Messrs. Teall?—No.

14,224. What quantity of grease do you extract per week?—I think we extract about a ton and a half per week.

14,225. I think you stated that you pursue the same system as Mr. Briggs, and make the soap yourselves?—Yes, we do.

14,226. Do you make it caustic?—Yes.

14,227. Do you use potash and soda?—Both. I think we buy soap as well.

14,228. How much oil do you buy in a week?—I think we buy a ton of oil in a week, or perhaps more.

14,229. You use a ton and a half of grease. How much do you get back?—I cannot say from memory, but I think it is from one to two tons a week of different material.

14,230. What do you sell it for?—About 17*l.* or 18*l.* a ton, but I am speaking entirely from memory. Then there are the expenses. I think we make something like from 200*l.* to 300*l.* a year profit out of the process.

14,231. (*Chairman.*) You convert so much of it into useful material?—Yes, every ounce of it that we can, but we cannot treat all the waste liquid so.

14,232. (*Professor Way.*) What did Messrs. Teall pay you for the right of extracting grease?—I think they paid us 5*l.* a ton, but then we found the steam.

14,233. Then you got nearly as much profit as you do now, without the trouble, except that you found the steam?—Yes, we found the building and all the apparatus.

14,234. Then they gave you nearly as much as they could afford to give you?—I suppose so, but we would not allow it to be done any more.

14,235. If you only make 300*l.* a year now, and you use a ton a week, at 5*l.* a ton they would have paid you 250*l.*?—I do not think there was so much as a ton a week.

14,236. The difference between what you paid and what you make now may be considered as their profit?—Yes, I consider that we make 100*l.* more of it than we did.

14,237. Do you treat all the soap liquor?—Yes, the whole of it from the works which are in a position to admit of the liquor running into tanks. At one portion of the works we cannot get the soapsuds into tanks, and those soapsuds go into the stream, and have done so for 50 years past.

14,238. As you arrive at the last part of the process of washing the wool and the worsted, the water, I suppose, gets tolerably pure. Does it all go through the process for grease extraction?—Yes, all of it.

14,239. Not merely the best part of the waste liquor but the whole of it?—Yes, it can go no other way but through the tank.

14,240. When it is collected there, and acids are added, a settlement takes place, and a scum is formed?—Yes, it is broken with sulphuric acid.

14,241. Is the liquid tolerably clear?—It is not clear when it runs away. We run it on to filtering beds.

14,242. Does that operation clear it?—Yes.

14,243. What passes away?—It is the liquid, after the grease has been broken.

14,244. I suppose there is still some grease in it?—Yes, we do not get all the grease out.

14,245. Do the ashes after a time block up?—Yes. We have large tanks about the size of this table, and the depth of the area filled in with ashes is twice the size of this table. The tank is 16 or 18 feet long, about two yards wide and one yard deep.

14,246. The tanks are filled?—Yes, and whenever the liquid is let out from the grease-house tanks it runs through pipes on to filtering beds, which are beds of ashes of considerable thickness, from about 12 to 15 feet thick, of solid ashes, which we take from the engine-boilers.

14,247. How do you get those ashes into the tanks?—The tanks are made in the ashes.

14,248. How long will it be before these ash-beds choke?—We clean them out perhaps once a month.

14,249. Do you keep up the same sides to them, or do you make new ones?—No, we just clean them out. The sides stand; we clean them out, and then we throw the stuff on to the side, and lead it to the land about once a month.

14,250. Is the water that comes away tolerably clear?—As clear as gin, quite clear.

14,251. What quantity of acid do you use in the course of a year?—I cannot speak to that.

14,252. Do you use oil of vitriol?—Yes.

14,253. Do you know the quantity of wool that you wash in a year?—We wash about 120 packs a week.

14,254. How much soap do you buy?—About 12 packs a week.

14,255. Including what you make?—Yes, what we make with the oil.

14,256. If it could be shown by the figures you give that you do not get all the grease out, I suppose if it could be done it would be worth doing?—Yes, and we should be very glad to do it.

14,257. Do you use the grease over again?—No.

14,258. You do not make soap of it again?—No.

14,259. Supposing you used a certain quantity of soap, containing so much grease, and a certain quantity of oil, every week, do you fancy that you get anything like that quantity back again in weight?—I should think not.

14,260. (*Mr. Harrison.*) You say that the water comes away from the ashes very bright and clear, but do you find that nearly the same quantity passes away into the brook as you used in the first instance?—No, because there is very great evaporation in the boiling tanks.

14,261. Afterwards, in passing through the filtering beds, is there much loss from evaporation?—Yes.

14,262. In some places the quantity of water taken from a brook for such purposes affects the power at the mills below, and the millowners below are very tenacious of any abstraction of water which is not returned to the brook. As affecting the question of water power, what may be the loss between what you take out and what you restore to the brook?—I could only make a mere guess.

14,263. I presume the quantity must be very much diminished?—Yes, there is no question about that. It is used in the steam engines as well as in the boilers.

14,264. The Doe Park reservoir is not I believe on your stream?—No, the water from that goes into the Harden Beck, a little below the point where our stream goes in.

14,265. (*Chairman.*) You were defendant I believe in the recent suit of Ferrand v. Townend?—Yes.

14,266. What was the cause of the proceedings in that case?—The plaintiff alleged that I polluted the stream by letting the water out of the Cullingworth reservoir.

14,267. Do you mean the reservoir where you impound the water?—Yes.

14,268. The pollution was caused by letting out the mud?—Yes.

14,269. Was the complaint confined entirely to pollution by mud?—Ultimately it was so. He alleged that it killed his fish.

14,270. How has that suit terminated?—We have got all our rights, but we have been saddled with costs I am afraid.

14,271. Did not that case involve the question of polluting the stream by soap waste?—That question was brought in in the proceedings, but it ultimately turned almost upon the point I have mentioned, the flushing of the reservoir.

14,272. When was judgment pronounced in that case?—About three weeks ago.

14,273. At what date?—I cannot say.

14,274. What is the effect of the decision?—The effect of the decision is that we are to treat the stream as we had hitherto done up to 1864, and that is as much as we ever wished to do.

14,275. But I suppose you are not again to flush the reservoir into it?—Yes, we are.

14,276. And to foul the stream again?—Yes.

14,277. And to kill the fish again?—Yes.

14,278. Was the great point in this case that you allowed a large quantity of mud to collect, and you then sent it down in a large body, and is this the result, that you are to be permitted to flush it from time to time more frequently, instead of at longer intervals?—There is no restriction put upon us whatever, but that we are only to do what we had done up to that time. We had been accustomed for 50 years to flush the reservoir out every year, and we had always done it at what is called "Bingley tide," that is at the time of a holiday.

14,279. (*Professor Way.*) How long have you been in the habit of filtering the water through ashes after separating the grease?—Ever since we began the operations, six or seven years ago.

14,280. Did you discontinue that practice at any time?—No.

14,281. Was not that one of the complaints made by Mr. Ferrand?—I think not.

14,282. Not that you had left off doing something which you had done before to purify the water?—I think not.

14,283. (*Mr. Harrison*). Is the mud which you pass out from the reservoir brought down the stream from above your works?—Yes.

14,284. It does not come from your works?—Not at all. A great portion of it comes from the sewage of the village and some tanyards and collieries above us. Those remain, and in 12 months our reservoir will be 18 inches deep in mud, but we do not put an ounce in ourselves.

14,285. (*Chairman.*) Before whom was this suit tried?—Before Sir John Stuart.

14,286. At what date?—About three weeks ago.

14,287. Have you any idea what the cost of that suit was to you?—No.

14,288. (*Mr. Harrison.*) You have been put to this expense in consequence of nuisances caused by persons situated above you. If there had been a law to prevent them passing sewage into the beck, your reservoir would not have been polluted, and you would not have been subjected to a lawsuit?—That is so. A great deal of pollution comes from the roads as well as from the cottages in the village, and ashes that are washed off the roads.

14,289. (*Chairman.*) Do you know whether it is the practice of any manufacturers on any parts of the stream above you to put ashes into the becks?—There are no mills above us.

14,290. Are you at all affected by floods?—Yes.

14,291. Do tanners put any waste materials into the streams?—Yes.

14,292. Does that practice injuriously affect the water for your purposes?—Yes.

14,293. Have you had any difficulty with tanners with regard to pollutions?—We have remonstrated with them, and one of them has given the practice up now.

14,294. Is there any person below you who is liable to be affected by your operations?—Yes, there are some mills below us, between Cullingworth and Bingley, worsted spinning manufactories.

14,295. Do they use the water as you use it?—Yes.

14,296. Have you had any difficulty with them about the water?—When we let out Ellar Carr dam, soon after we bought it, there was a deal of mud in it, and it filled up our neighbour's dam, and he said that we ought to help him to defray part of the cost incurred in getting it out again.

14,297. Did you do so?—Yes, we did. We were disposed to be friendly with our neighbour, and did not wish to go to litigation.

14,298. Have you formed any opinion as to whether it is advisable to have any sort of conservancy for the management of rivers and streams, to prevent pollution and to settle disputes without great cost?—Yes, and I think it would be well if it could be arranged.

14,299. Do you think that there might be an arrangement so that any difference between neighbours,

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as between you and Mr. Ferrand, for example, might be settled without great costs?—Yes.

14,300. Is there any tribunal with more simple machinery that you might have gone before to settle the matter?—I should think there is, certainly; a common action would have been much more simple.

14,301. How long were those proceedings pending?—They began in 1864.

14,302. And you only obtained a decision three weeks ago?—That was about the time.

14,303. You were in litigation for two years?—Yes.

14,304. (*Mr. Harrison.*) Do you think it would be any hardship to call upon all manufacturers to purify their soapsuds to the extent that you do?—Not at all. I consider that it would be a benefit to them.

14,305. Not merely the first process, as practised by Le Page and Company, but the second process of filtering the soapsuds through ashes?—Yes; but I do not think there is any profit to be made by the second process.

14,306. Can it be done without actual loss?—I think there is a loss in it, because we do not get as much tillage by it as the labour is worth.

14,307. (*Professor Way.*) But the stream would be benefited?—Yes, considerably.

14,308. (*Mr. Harrison.*) It would be no hardship to call upon all manufacturers to do the same as you do?—No, it would be a benefit to them if they had convenience for it, it depends a great deal upon that. We are well situated, and have laid out much money.

14,309. (*Chairman.*) You have striven to keep your own premises in good order, and to keep the stream pure?—Yes.

14,310. Do you think you have succeeded?—Yes; we have done it for the sake of profit and our own convenience. We have land below, and we do not want to foul the stream.

14,311. Yet you have been punished in the shape of law costs more than many men who pollute the streams much worse?—Yes, ten times worse.

14,312. (*Mr. Harrison.*) You have suffered from the pollutions of others?—Yes. I wish to add this, that the streams in our neighbourhood are more polluted from other sources than from our works. I mean by refuse from cottages, and by the general drainage of the country roundabout, and from the roads. We do not put five per cent. of the pollutions into the stream that we did 30 years ago.

14,313. (*Professor Way.*) Do you think that that is commonly the case with manufacturers?—By no means.

14,314. (*Mr. Harrison.*) Would the water that issues from your ash filters be suitable for the purposes of the mills below you?—Yes, certainly, for any purpose whatever, for dyeing.

14,315. (*Professor Way.*) Do the ashes make the water hard?—I am not aware that they do; we have had the water analysed.

14,316. (*Chairman.*) What kind of dye do you use?—We only dye blacks.

14,317. Do you use indigo?—No.

14,318. (*Professor Way.*) Do you dye with logwood and campeachy?—Yes, and copperas.

14,319. Does the dye waste pass through ashes as well?—Yes.

14,320. Does the water come away clear?—Yes. That we have done for a few years back; we used to put it all into the stream, but not since 1854.

14,321. Is that waste filtered in the same filter beds?—No, the soapsuds and dye waste are kept separate from each other.

14,322. Is the bed raised very considerably by that dye waste?—No; we clean out the filter for the dye waste just the same as the other filter.

14,323. But I suppose there is a good deal more refuse to clean out?—No; we mix the refuse up with the ashes for the land, although we do not think there is any great value in the mixture so produced.

14,324. Has the dye waste ever been tried by itself?—I do not know.

14,325. Does it not contain a quantity of iron?—

14,326. Is not that injurious to land?—I do not think it is, but we have never tried it separately.

14,327. I suppose that stuff is much of the same nature as the dye that is fixed in the cloth itself?—I think so.

14,328. It is not worth anything for any practical purpose?—I believe not, but we have never tried it; we never thought there was any value in it; we never tried the liquid upon the land.

14,329. Does the water run away quite clear from the beds?—Yes. I suppose that we can turn it into the stream after the decision that was pronounced, if we like.

The witness withdrew.

Mr. T. B Laycock.

Mr. Thomas Brigg Laycock (Keighley) examined.

14,330. (*Chairman.*) You are a worsted manufacturer?—Yes.

14,331. Where are your works situated?—At Bingley.

14,332. You are a member of the Bingley Improvement Commission?—Yes.

14,333. What number of hands do you employ at your works?—About 200.

14,334. Are your works situated upon any stream or beck?—They adjoin the canal.

14,335. What canal?—The Leeds and Liverpool Canal.

14,336. Do you get your water from that canal?—Yes.

14,337. Do you use engine power?—Steam power.

14,338. What weight of coal do you use in a year?—Taking the year round, about eight tons per week.

14,339. What becomes of the ashes?—They are led away.

14,340. At what cost to yourselves?—I do not know. I keep a horse, and I have them led away for 1*s.* 6*d.* a week, or 6*d.* a cartload; we have convenient places near.

14,341. What kind of accommodation have you for your hands?—We have privies outside the building, with doors opening into the interior.

14,342. What becomes of the refuse?—It goes into a cesspool, and we lead it away in barrels about once in three weeks, when the cesspool is full. We mix the refuse with gravel or soil, and use it as manure.

14,343. What volume of water do you use on your premises?—I do not know.

14,344. Where do you get it from?—The canal.

14,345. What do you pay the owners of the canal for it?—6*l.* a year, and we turn the water back into the canal.

14,346. Do you use any soap?—No; we do not pollute the water.

14,347. You take it out and use it for engine power and send it back again?—Yes.

14,348. Is there any water supply for Bingley?—We have a supply now, but previously to 1862 water was supplied by Mr. Ferrand solely. In 1862 the Commissioners purchased the right of Mr. Ferrand, and agreed with him for 30 years' supply of water, 10 years at 500*l.* a year, and 20 years at 600*l.* a year. That agreement is now in operation. For the construction of these waterworks the place is rather convenient. We have seven springs in three different directions, but we are not obliged to carry the works through any other person's property except Mr. Ferrand's. The arrangement is between him and the Commissioners, and is free from difficulty.

14,349. What is the population of Bingley?—About 6,000.

14,350. What is its rateable value?—I think about 10,000*l.*

14,351. Is Bingley sewered?—It is.

14,352. Where do the sewers empty themselves?—Into the river Aire.

14,353. Has there been complaint made by anyone of a nuisance having been caused by that?—I do not know that there has been. Mr. Ferrand has mentioned the matter to me. I should mention that we have made a tunnel (for it is very peculiar ground for drainage, in fact the worst possible ground, for it has high and low levels), there is a plot of over three acres adjoining the canal, and this ground is lower than the canal bank, it fronts the canal for 240 yards, and one-third, I should say, or one-fourth of Bingley drains into this place. The main sewer runs down along the canal bank, and when it was open in the summer time it was not fit for anyone to pass along the canal bank; it was an open cesspool and exposed to the weather. The Commissioners took the matter up, and they made a drain under the town, which cost something like 1,100*l.*, which has now taken all the refuse away.

14,354. You have removed that evil by conducting the sewage direct into the river?—Yes, it went into the river before, but in a circuitous and objectionable way.

14,355. I suppose floods do not affect you?—Very little; the recent flood affected the corn mill at the side and a cottage or two.

14,356. Have you observed the effect of the flood in the valley?—Yes.

14,357. Was it very destructive?—In Bingley Vale there is not much damage done except in some places the river washed a little wider.

14,358. Have you paid any attention to the floods since you have resided here?—Yes, within the last seven years, I have always lived here, and I know something of the floods.

14,359. Can you draw any comparison between the recent flood and other floods which you have seen?—I should say that the last flood was the greatest I ever saw. When Mr. Brigg gave his evidence here he referred to a flood at Stockbridge 29 years ago. I remember very well the carriage of Mr. Hall, a solicitor in this part, who was going to be married, going through the water at Stockbridge. I do not think the water had ever crossed the road from that time until now.

14,360. Did it come across the road on the recent occasion?—Yes.

14,361. Are you aware that a weir has been taken down there which has lowered the river four or five feet?—Yes, and I should say that the flood would have been much deeper at the crossing of that road if the weir had not been taken down, and the bridge would have been in great danger. I was there a little after the bridge gave way.

14,362. Is the bed of the Aire filled up at all below Bingley?—I should think that it is not much filled up. I think that any refuse that may be thrown into the river above Keighley would assist in filling up the river before it got to Keighley. We have a weir about a mile from Bingley called the Castlefield weir, and that weir I think would stop anything coming down.

14,363. (*Mr. Harrison.*) Between the river Worth and that weir is the bed of the river altered much?—Yes, it is raised much at one point, I think it has risen a yard, but that is on account of the current, and of course the refuse must settle somewhere, it cannot go down below Bingley.

14,364. Has that rising of the bed of the river caused the flooding to be greater than it used to be?—Yes, and also the quick current has had that effect.

The witness withdrew.

The witness subsequently added to his evidence the following statement: As a proof that Bingley sewerage does not foul the river injuriously to health, within 300 yards of the centre of the town and the outlet into the river Aire, there are a quantity of trout. I have asked two old fishers, and they tell me there never were more; one man said there were thousands of trout, and the other said the water almost lifted with trout. It is preserved by Mr. Ferrand.

Mr. John Clough (Keighley) examined.

14,365. (*Chairman.*) In what business are you engaged?—I am a worsted spinner and manufacturer.

14,366. You represent the firm of Robert Clough and Company of Grove mill, near Keighley?—Yes.

14,367. Do you use steam or water power?—Both.

14,368. To what extent do you employ water power?—The extent is not ascertained, it is very irregular.

14,369. What quantity of coal do you burn in a week?—On the average about 25 tons a week.

14,370. What do you do with the ashes?—Within the last three years we have used them in building operations.

14,371. Do you grind them with mortar?—We use the largest for making roads, and the smaller for mixing with lime, only the remnant we put away into the stream.

14,372. Do you put any into the stream now?—Very few.

14,373. But you do occasionally?—We have put in very few during the last three years.

14,374. Do you use water in your manufactures?—Yes, for washing wool.

14,375. To what extent?—I cannot tell that, but we have plenty of it.

14,376. Do you take it from the beck?—No, from our own reservoir.

14,377. Of what area is that?—Perhaps it has a surface of an acre and a half.

14,378. Of what depth?—The average available depth is six feet.

14,379. Is it spring water?—No, river water.

14,380. Do you catch it from the stream?—It is taken at the dam stones.

14,381. How often do you cleanse the reservoir out?—Sometimes we do not do it for two years.

14,382. When it is done is the refuse flushed into the river?—Yes.

14,383. Has any person below you ever complained of that?—They have complained just at the time after we have been flushing, if they have been working, the refuse has got into their pump and stopped their machinery for a time.

14,384. How many hands do you employ?—About 320.

14,385. Have you provided privies or waterclosets for their accommodation?—Privies.

14,386. What becomes of the refuse?—The privies are in rows on one side and the other, the sewage is taken down through an iron pipe into a waggon or box which is on wheels, and then it is carried away to the land and mixed with the soil.

14,387. Does any of that refuse go into the stream?—Not a drop of it that we know of, we use it on the land.

14,388. Has the bed of the stream been raised since you remember it?—I consider that it is half a yard lower opposite to us than it used to be.

14,389. Is it lower before you have cleansed the reservoir out?—Yes, by the natural washing of the stream.

14,390. Is that the case all through the town of Keighley?—I cannot give any evidence about the town.

14,391. But it is lower opposite to your works?—Yes.

14,392. Have you suffered by the recent flood?—Yes, we have.

14,393. In what way?—Our fires, or at least our

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flues, were filled up about 9 o clock on Friday by that flood, I mean the flue under the boiler going to the chimney.

14,394. And the water stopped the machinery?—Yes.

14,395. How long did you stand still in consequence?—We stood still all that day, but in the afternoon the water ran over our dam bank, and through our boiler house; but we attribute the first four hours of our standing still to the bridge that has been made by the Keighley and Worth Valley Railway Company—a timber bridge standing on piles driven into the mid stream with no allowance for the piles.

14,396. You think that that bridge or viaduct backed the stream up, and caused you to be flooded?—Yes, from two to three feet, that was just the difference it made in our case.

14,397. Have you remonstrated with the company?—Yes, we did at once.

14,398. What have they said?—Nothing yet.

14,399. Have you any idea of making them pay for the damage they have caused?—We have given them notice to that effect.

14,400. Did you notice what they were constructing when they were putting the bridge up?—Yes, we remonstrated with them at the time.

14,401. Did they not take any notice of that?—The engineer in chief said that they would allow waterway for the piles, but they never did.

14,402. If you have been flooded in consequence this time, you will of course be liable to be flooded again?—Yes, by a similar flood.

14,403. Was this a greater flood than you ever remember before?—Yes, I never recollect such a flood.

14,404. (*Mr. Harrison.*) Do you wash wool in the way that Mr. Townend mentioned?—We use the same system partially, to the extent of half our operations; for the other we use soap, the ordinary marketable soap.

14,405. What do you do with the soapsuds?—At the present time we turn them into the stream, but we have built a new mill recently, and a building to extract the suds on the same system as Messrs. Townend pursue.

14,406. Do you think you will carry it out as effectually, so as to send the water away from your premises in a pure state?—I have heard Mr. Townend's evidence, and I scarcely think that we have room for the sort of filter bed that he mentioned. I have not seen his filter beds, but I did see the soap beds. We have neither space nor fall for the filter beds.

14,407. (*Chairman.*) How many packs of soap do you use in the week?—Five.

14,408. (*Mr. Harrison*) In cleansing what weight of wool?—Between 50 and 60 packs per week.

14,409. How much soap and oil do you use?—We use five packs of soap, and we use in alkalies and oil equivalent to five packs of soap.

14,410. Do you dye as well?—Not at all.

14,411. If it can be shown that a filtering arrangement similar to that which is carried out by Messrs. Townend could be used, occupying only a small space, would it be any hardship to you if you were compelled to filter all the water as he does, and pass it away pure?—We should not consider it a hardship. I think it would make it necessary for us to pump the soapsuds up to a filter bed, but if everybody above us sent the water down pure, we should not make any objection.

14,412. Would not the advantage of getting clean water for cleansing be greater than the injury of being obliged to pump the soapsuds up?—We have occasionally experienced a very disagreeable smell, which we have attributed to letting the liquid out of the sud tanks above us, it was a peculiar smell, and it got into the mills occasionally; but the volume of water is so great that comes down the stream, that we have not found the pollution to affect our wool-washing operations, the smell is only disagreeable occasionally, and I have not noticed it lately, but the last summer has been wet.

14,413. (*Chairman.*) You might observe it more in a dry summer?—Yes, if the soapsuds were turned into a very small stream.

14,414. (*Professor Way.*) I suppose you would say generally that purification of the streams is so much to be desired, that it would be worth while for each manufacturer to incur some expense to accomplish that object?—I think it is very desirable, and we should not object to take our share in keeping the water pure, and keeping all solid materials out of the stream.

14,415. And as far as you could in preventing pollution from wool washing?—Yes, we are preparing to extract the bleach.

14,416. The proper plan I suppose would be for each manufacturer to refrain from polluting the stream?—Yes, I think so.

14,417. Prevention being better than cure?—Yes. It appears, as far as the worsted manufacture is concerned, that prevention is a means of profit, the extraction at least of the soap is a profit.

14,418. In making that profit, it would be fair nevertheless that you should be asked to discharge the liquid as pure as you could, even if it should diminish your profit?—Yes, if everybody above us did the same; I think we should derive a certain benefit from receiving the water purer, although it seems pure enough.

14,419. You probably heard Mr. Townend say that without filtration the liquid, after it comes from the grease separating process, still comes in an objectionable condition, but filtration through a bed of ashes sends the water away in an unobjectionable condition?—Yes.

14,420. That of course would be attended with a diminution of profit, because filtration would cost money?—Yes.

14,421. May it not nevertheless be said that a diminution of profit would be quite a tolerable thing if you gain an advantage in the end?—Our circumstances are different. Messrs. Townend's premises are situated on a very small stream, while we are on a large stream, and the quantity of turbid water that is turned out from our works bears a very small proportion to the whole volume of the stream, whereas in Messrs. Townend's case, it bears a larger proportion. In my opinion the simplest course to pursue is to stop out all impurities.

14,422. And you would not object to a general law to effect that purpose?—I do not think we should.

(*Mr. Townend.*) I may remark that our stream is so small that in the summer time all the sewage lodges in the brook, and there is not a sufficient flow of water to take it away, there is scarcely a run at all from the cottages or the ditches, all refuse is taken away with the first flood that comes.

14,423. (*Professor Way to the witness.*) Can you state what quantity of oil you use?—I cannot state it off hand, 132 lbs. of oil represent a pack of ordinary soap, such as we use.

14,424. The compound is nearly half oil, is it not?—Yes.

14,425. Is it the oil that you expect to recover?—I was wrong in the figures. I should have said 84 lbs. of oil are used in 256 lbs. of soap.

14,426. That would be about one-third?—Yes, that is to say, we should use 84 lbs. of oil where we used a pack of soap under the old system.

14,427. Supposing you were paid as Mr. Townend was by a company for the right of extracting the soap, you would be paid I suppose for 84 lbs.?—Yes, we should reckon on 84 lbs of oil.

14,428. Out of a pack of soap, or its equivalent?—Yes.

14,429. Is that the only oil that you use?—No, we use oil in combing the wool, oil is put on to the wool.

14,430. Are the goods washed afterwards?—Yes, but that is after they leave us. We wash some of our yarns, or scour them, and the warps, the double warps, we scour.

14,431. (*Chairman.*) Do you use urine in any of your processes?—No.

14,432. Is it used in the Keighley trade?—Not that I know of. I have heard of its occasional use for very dirty warps.

14,433. Is there anything of the kind used, such as pig dung, or refuse of that kind, in the woollen manufactures?—They are not at all suitable for our trade. We do not use the short fibres that are produced in the combing operation, they have to be sold for another purpose.

14,434. Do you dye?—Not at all.

14,435. (*Mr. Harrison.*) Do you use any foreign wool?—No, we use no foreign wool.

14,436. What loss do you sustain in cleansing the wool?—In fine English wools we lose as much as 3 lbs. out of 16 lbs., the average loss is from 2 lbs. to 3 lbs.

14,437. Do you use Scotch wools?—Not at all.

14,438. (*Chairman*) What is the price of that class of wool at the present time?—From 1*s.* 7*d.* to 2*s.* 2*d.* a pound.

14,439. What is the ordinary price?—I cannot say.

14,440. Has wool increased in value recently?—It is very much higher than it was, but still it is lower than it has been.

14,441. Did the cotton famine cause the price of wool to rise?—Yes, it sprung up to 2*s.* 10*d.* instead of 2*s.* 2*d.*

14,442. Lancashire suffered by losing its trade, but Yorkshire was benefited by having an inland trade?—So it would appear.

14,443. As the supply of cotton got smaller the price of wool became higher?—Yes; the greatest variation in price that I ever knew of was from 1*s.* 0½*d.* a pound for the same class of wool to 2*s.* 10*d.*, and that was in Yorkshire hogs.

14,444. At what period did that alteration take place?—I think the price of 1*s.* 0½*d.* was just about the close of the Crimean war in 1854; we then had a severe depression in trade, and wool went down to that price.

14,445. At what time did it get up again?—It got up about two years ago.

14,446. In 1864?—Yes.

14,447. What would the price of the same wool be now?—About 2*s.* per pound.

14,448. Is there anything further you wish to add?—I forgot to mention that the piles of the railway bridge stopped five trees that were coming down; the bridge is on a curve, and the trees turned and drifted against the piles and stopped there.

14,449. Did that cause a flooding of your premises?—Yes, and in one room that we never anticipated.

14,450. Did that cause you much injury?—It injured the material, but we got the most valuable portions of it out.

14,451. To what extent do you consider you suffered in money value?—We do not know; we are drying the wool and repacking it to this day.

14,452. Will you apply to the railway company for compensation for the damage they have caused you?—Yes, that is what we think of doing.

14,453. (*Mr. Harrison.*) Do you mean a railway bridge that is near to the station?—No; it is on the Worth Valley Line.

14,454. (*Chairman.*) What is the name of the railway?—It is called the Keighley and Worth Valley Line; it belongs to an independent company.

The witness withdrew.

Mr. Edward Marriner (Keighley) examined.

Mr. E. Marriner.

14,455. (*Chairman.*) You represent the firm of B. and W. Marriner, worsted spinners, at Keighley?—Yes.

14,456. Where are your works situated?—On the river Worth.

14,457. What number of hands do you employ?—About 400.

14,458. What weight of coal do you burn in a year?—About 1,300 tons.

14,459. Do you use water power?—Yes.

14,460. What do you estimate the power to be?—The nominal power is 40-horse.

14,461. Can you work at that rate?—Not all the year round.

14,462. How long has the wheel been in use?—A great number of years.

14,463. Is it as serviceable to you now as when it was first put up?—No.

14,464. Has the tail-goit been choked up?—No; I think that less water comes down the river.

14,465. In consequence of the reservoirs that have been constructed?—I do not know.

14,466. Were you at all affected by the late flood?—Not very much; we are rather away from the course of the river.

14,467. Do you use water in your manufacturing processes?—Yes, for washing wool.

14,468. In the same way that the last witness stated he did?—Yes.

14,469. Do you dye at all?—No.

14,470. Do you use soap and oil?—Yes.

14,471. What weight do you use per annum of soap?—Nine or ten packs a week.

14,472. What quantity of oil do you use?—I do not know.

14,473. Do you recover waste refuse from the soap suds?—Yes.

14,474. Do you perform that operation yourselves?—No, we lease it to someone else.

14,475. Do they take the refuse away?—Yes.

14,476. They do not treat it on your premises?—No, they mix it up and take it away.

14,477. What do they pay you per annum for it?—I cannot say, but it is so much per pack.

14,478. How much per pack do they give you?—I do not know, 3*s.* or 4*s.*

14,479. Have you provided privy accommodation for your hands?—Yes.

14,480. What do you do with the refuse?—We use it for manure.

14,481. It does not go into the stream?—Not at all.

14,482. Is the water that comes away very dirty?—No, I do not know that it is.

14,483. Are there manufactories situated below you?—Yes.

14,484. Have any complaints been made of your polluting the stream?—No.

14,485. Have you complained of any persons above you for doing so?—No.

14,486. What do you do with the ashes?—They are carted away to repair the roads.

14,487. Do you ever put any of them into the stream?—We have not done so for the last 10 years.

14,488. Do any persons above you put their ashes into the stream?—I suppose so, but I do not know.

14,489. Do you think that the bed of the stream has been raised opposite to your premises?—I do not think it has very much.

14,490. How long have you known this stream?—Four or five years personally.

14,491. Do you remember a flood before the last flood?—No.

14,492. How long have you recovered the refuse from your soap and oil?—I should say six or seven years. I cannot state exactly.

14,493. What weight of wool do you treat at your premises?—About 80 packs per week.

14,494. Into what is it manufactured?—Into yarn.

14,495. Where is it worked up? In Bradford?—We only spin, and it goes away to Bradford; it goes abroad from there.

14,496. What wool do you use?—English and foreign.

14,497. Where does the foreign wool come from?—From Port Philip and Van Diemen's Land.

14,498. Do you use more Australian than English wool?—We use more English.

14,499. Do you use them separately, or do you mix them?—We use them separately.

14,500. (*Professor Way.*) Is the water which comes away from the grease process clean?—No.

14,501. Have you tried any method of making it clean?—No.

14,502. Who are the people who treat your grease; is it Le Paige & Co.?—The people in the town here take it, namely, Listers.

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14,503. Do you supply steam for the tank?—Yes, we pump.

14,504. Is the liquid treated?—No.

14,505. (*Chairman.*) In washing your wools have you much loss in weight?—Yes.

14,506. About what proportion of loss have you in your English wools?—From 3 lbs. to 4 lbs. in 16 lbs.

14,507. And what in your Australian wools?—From 5 lbs. to 6 lbs.

14,508. Is the loss owing to the dirt which is washed out?—Yes, and grease out of the wool.

14,509. Then the Australian wools come to you dirtier than the English wools?—Yes, they are more greasy.

14,510. And you lose more in weight?—Yes.

14,511. Did you ever hear of the process by a French patent of getting carbonate of potash out of wools in the first washings?—No.

14,512. What do you do with the water in which the wools are washed at first?—It goes into the tank.

14,513. That is the water from which you extract the grease?—Yes, the whole of it goes in; parties take it all, and the spare water goes into the beck or river.

14,514. If it could be shown to you that you could clarify that water to a certain extent by an ash filter, such as you have heard described by Mr. Townend, should you have any objection to try the process?—I should think not; it depends upon the cost.

14,515. (*Professor Way.*) You would object still less, if you could do it in less space than that which an ash filter takes up?—Yes.

The witness withdrew.

The witness subsequently informed the Commission that, according to the opinion of the elder workmen, the bed of the river Worth had been raised at least 12 inches in the last 10 years: the personal observation of the witness being as stated in answer 14,489.

Mr. R. N. Sugden.

Mr. Robert Newsholme Sugden (Bingley) examined.

14,516. (*Chairman.*) You are a worsted spinner?—Yes.

14,517. Where are your works situate?—About three miles from Keighley, up the Worth valley.

14,518. In the Bingley district?—In the parish of Bingley.

14,519. What number of hands do you employ?—About 700.

14,520. What accommodation have you for your hands; have you privies?—Privies.

14,521. What becomes of the refuse?—It goes into tanks underground, and is carted away on to the land.

14,522. Do you use the water of the stream upon which you are situated?—Yes.

14,523. For washing?—No.

14,524. What weight of wool do you use per week?—We use about 100 packs a week.

14,525. What weight of soap and oil do you use?—We do not wash all the wool on the premises. We buy a good deal in the prepared state, tops.

14,526. Do you do any washing?—Yes.

14,527. And you use soap and oil?—Yes.

14,528. Do you treat the waste suds at all, so as to recover the material out of them?—Yes, we let them off to S. & C. Lister; they have the management of them.

14,529. Do they pay you so much per pack of soap?—Yes.

14,530. How much?—*3s.*

14,531. Do you find tank room on your premises?—Yes.

14,532. Do you find any steam?—No.

14,533. Is the grease extracted on your premises?—No.

14,534. Then the fluid refuse, whatever it may be, passes into the stream?—Yes, and the solid is taken away.

14,535. Do Messrs. Lister take the solid, or do you take it?—They take it.

14,536. And they do what they like with it?—Yes.

14,537. Do you use English wool or a mixture?—We use both English and foreign.

14,538. Do you use Australian wool?—We do not use very much Australian wool. Our principal weight is English wool.

14,539. Do you use any Scotch wool?—No.

14,540. About what is your loss in weight in washing English wool?—It will vary a little according to the cleanness of the wool. The loss is perhaps 2 lbs. or a little under 3 lbs. out of 16 lbs.

14,541. And what is the loss in washing foreign wool?—We do not wash foreign wool; it comes in a prepared state.

14,542. Where does it come from?—It is Australian wool.

14,543. Do not you use any continental wool?—A little.

14,544. In what state is the river now as compared with what it was when you first knew it?—I should think that it is somewhat similar.

14,545. Is the water of the river polluted when it comes to you?—More than it was formerly.

14,546. What mills or manufactories are there above you?—I cannot exactly state the number, but a good many.

14,547. You are on the Worth?—Yes.

14,548. Is the Worth a tolerably large stream?—It is a very good stream.

14,549. Did the flooding the other week injure you at all?—Not very much.

14,550. Was it as large a flood as you remember?—It was larger than I ever remember.

14,551. When we commenced our inquiry all our evidence went to this, that the floods were not so large as they had been formerly. I suppose you think that the late flood was otherwise?—The late flood was an extraordinary flood. The floods perhaps have not generally been so large lately as they were formerly. We have been at those works 23 years, and we have never seen such a flood before as the recent one.

14,552. It was not only a large flood but it was the largest which you recollect?—Yes.

14,553. Then any assertion that the floods are less than they were formerly is contradicted by this flood?—Yes.

14,554. Some people have thought that the land drainage has produced the floods?—This flood, I should think, was produced by the extraordinary fall of rain in a short time.

14,555. Do you know what height the water rose vertically opposite to you?—I should think that it rose from the bottom of the stream seven or eight feet high. I should think that that would be from 18 inches to two feet higher than we ever saw it before.

14,556. What weight of coal do you use?—That varies a great deal.

14,557. How much do you use per week upon the average?—About 35 tons a week.

14,558. What do you do with your ashes?—We use them for different purposes; for grinding up with lime, and for roads.

14,559. Do any of them go into the beck?—No.

14,560. Did you at any time put any of them into the beck?—Occasionally a few perhaps.

14,561. Do any of your neighbours above or below you put their ashes into the beck?—That I cannot say.

14,562. Have you a lodge for a reservoir attached to your works?—Yes.

14,563. Does it accumulate much dirt?—A little. We have a largish reservoir, and we have one goit which carries the stream which is parallel to the goit.

14,564. If you have any mud to get rid of it passes down?—Yes.

14,565. Are there are fish in the Worth at that point?—Yes.

14,566. Trout?—We frequently find trout in our reservoir.

14,567. They come from above?—From above and below.

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14,568. (*Professor Way.*) Are you not rather on a high part of the Worth?—Yes.

14,569. Therefore you are not liable to much pollution?—A good deal of pollution comes down. Gas tar comes down. I should say that it is more polluted by gas tar than by anything else.

14,570. (*Chairman.*) Where does the gas tar come from?—From the works above.

14,571. What works are they?—There are Messrs. Morrall's works, which are next to us upon our stream. Messrs. Hattersley's are upon the other stream. We are just at the junction of two streams.

14,572. And you occasionally get gas tar?—Yes.

14,573. Have you complained at all of that?—I do not know that we have.

14,574. Has it injured your goods in any way?—No, we do not find any injury from it, because we have a separate supply of water for our scouring purposes.

14,575. Do you get it from springs?—Yes, we have a reservoir for it.

14,576. Are you aware that gas can be made without passing any refuse of any sort from the premises?—It has not been done in our part of the country.

14,577. Are you aware that it can be done?—Yes, I have heard it stated.

14,578. That they can carry on the operation continuously, and never pass anything in the shape of refuse into the stream?—We do not pass gas tar into the stream.

14,579. Do you make gas yourselves?—Yes.

14,580. And you do not pass any of that refuse into the stream?—No.

14,581. Nor ammoniacal liquor?—No.

14,582. Nor spent lime?—No.

14,583. Do you think that it would be justifiable to prevent these people above you from putting in any gas tar or any refuse from gas works?—It would certainly keep the water purer.

14,584. Did the floods do much damage about you?—They did considerable damage above us at one place. I did not hear of anything but at that one place.

14,585. What is the name of that place?—It is called Lumb-Foot.

14,586. What did the damage there consist of?—A reservoir burst, I suppose, at the commencement; it blew out the shed side and ran through the shed.

14,587. That was a small reservoir belonging to private works?—Yes.

14,588. Did it do the owners much damage?—I cannot state to what extent. They will find, I believe, that there was considerable damage, but I have not seen the place.

14,589. You have heard I daresay that a large amount of damage has been suffered in the valley of the Aire from top to bottom?—Yes.

14,590. Do you think that it would be a benefit to you if you could get the water cleaner than it is at present, if any regulations could be carried out by which the water should be preserved?—We use the stream principally for power.

14,591. You are not dependent upon it?—We are not dependent upon the pureness of it.

14,592. (*Professor Way.*) I suppose that you know as a fact that there are manufacturers who suffer very much from the want of pure water in the streams?—I have heard it stated so.

14,593. Do you not believe that it is so?—Of course I cannot speak to that; I only go by report.

14,594. (*Chairman.*) You are fortunately situated so that you do not suffer?—We do not.

14,595. (*Professor Way.*) It is not everybody who is high up on a stream?—Everybody is not so high up as we are.

14,596. (*Chairman.*) Nor has everybody the same advantages as to pure water?—No.

The witness withdrew.

Mr. John Dixon (Keighley) examined.

Mr. J. Dixon.

14,597. (*Chairman.*) How long have you been resident in Keighley?—Ten years.

14,598. How long have you been the certifying surgeon under the Factories Act?—Rather better than eight years.

14,599. Who is the inspector who takes this district?—Mr. Alexander Redgrave is the inspector, the sub-inspector is Mr. Rickards of Leeds.

14,600. How many mills have you under your supervision?—I generally keep the account according to the number of sets of books that I have; I certify in books. For instance, there is one mill in this town which has four firms in it; in my way of counting I call that four mills, and in that way I have about 35 or 36 sets of books, although there are not 35 or 36 mills in reality.

14,601. (*Mr. Harrison.*) But you have that number of parties with whom you have to deal?—Yes, some parties may have two or three mills, but still they are distinct so far as my duties are concerned.

14,602. I suppose that your duties do not bring you into collision with manufacturers, as regards the quality of the water or its pollution, or anything of that kind?—Not at all.

14,603. Or any interference with the river?—Not at all.

14,604. You simply certify that certain regulations are complied with under the Factory Act?—Just so.

14,605. What is the general health in this district?—I am not at present in practice myself, I have been obliged to retire from general practice on account of ill health; but I believe that yesterday you examined Mr. Milligan, and he is the gentleman who is most likely to give you the fullest information on that point, because he has made it a study. But I should say, generally, that the health of this district at the present time is about the average.

14,606. (*Professor Way.*) Do you visit the mills at any regular intervals?—Once a week, except three to which I go once a fortnight.

14,607. Is it your duty to do so?—It is my duty to do so.

14,608. Under the Act?—Yes.

14,609. You have a right of course to go into those mills at any time?—Exactly so.

14,610. Have you any other occupation?—Not at present.

14,611. If you were visiting those mills, would you have an opportunity of seeing whether any discharge of an objectionable kind was taking place from the factories into the water?—In some instances I should.

14,612. (*Chairman.*) Is Mr. Redgrave resident in London?—Yes.

14,613. At Brompton?—I believe so.

14,614. (*Mr. Harrison.*) Do you find that the conditions of the Factory Act are generally well complied with in this neighbourhood?—Yes, so far as my duties are concerned, in fact I believe that they are complied with generally. I believe that it is the desire of manufacturers in this district to comply with the Act so far as they can.

14,615. In the course of your inquiries have you to take a record of the number of hands, men, women, and children, employed in the different works?—No, the sub-inspector generally does that. I simply certify that they are of a certain age, and of good health and strength, and so on.

14,616. Do you find that the health of the people who are employed in such manufactories is pretty good?—Yes, generally speaking, I think that it is pretty good.

14,617. (*Chairman.*) Have you any further remarks to offer to the Commission?—No, I do not know that I have, except that as a medical man I think that the carrying out of the Factory Act is beneficial in many

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respects, both to the physical and the moral condition of the people. You have less of deformity, and evils of that sort, than used to prevail at one time. I think that the Act has had a very excellent effect.

14,618. And it has not been ruinous to the manufacturers themselves?—I should say not, judging by their progress.

14,619. And you do not find any factious opposition on the part of any of them to your doing your duty?—Not at all.

14,620. They are rather glad to see you than otherwise?—I hope so.

14,621. At all events they do not make it appear that you are not welcome?—No.

The witness withdrew.

Adjourned to to-morrow at 11 o'clock, at Skipton.

Skipton, Thursday, 29th November 1866.

PRESENT:

JOHN THORNHILL HARRISON, ESQ., IN THE CHAIR.

Professor JOHN THOMAS WAY.

CHRISTOPHER SIDGWICK, Esq. (Skipton), examined.

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C. Sidgwick, Esq.

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14,622. (*Chairman.*) You are chairman of the local board of Skipton?—Yes, I am for this year. It is an annual election.

14,623. For how many years has there been a local board established at Skipton?—For eight years, from June 1858.

14,624. Have you been frequently chairman of the board?—I have been chairman for the last 5½ years.

14,625. You are therefore thoroughly acquainted with everything coming within the jurisdiction of the board?—Yes.

14,626. What is the extent of the district under the management of the local board?—I cannot tell you the area of the district.

14,627. Does it include the town and part of the neighbourhood?—It includes the town and land round about it for perhaps a mile and a half in diameter.

14,628. Can you state what the population is within the boundary of the district?—About 5,000. It is rather less than it was.

14,629. Within what period has it diminished?—Within two years, or since the effects of the American war were first felt.

14,630. How would you account for the diminution?—Business has become slack, and the poorer population have been seeking work at Bradford and other places.

14,631. What is the special business carried on in Skipton?—Cotton manufacture chiefly.

14,632. As the cotton manufacture was injured by the American war the trade of Bradford and other places was improved, and your population was taken away, I suppose?—No doubt. Wages are higher at Bradford than at Skipton.

14,633. What works have you been carrying on in the town?—We have sewered the whole town, and perhaps drained a third of it, but the house drains have not been connected with the sewers as quickly as they might have been.

14,634. Have you been introducing watercloscts generally into the houses?—The board of health are divided in opinion upon that subject. Some of them would at once do away with cesspools and everything of that kind, while others look at the cost to the owners of the houses. The result is that the cesspools have sometimes been ordered to be cleared and not to be destroyed.

14,635. Has the board of health taken in hand the cleansing of the cesspools and ashpits in the town?—No. The inspector of nuisances has power to cause any nuisance to be abated under the Act of Parliament in 24 hours, and if it is not abated he reports to the board, and then the board, or some of them, would at once order the cesspool to be turned into a watercloset. The board, however, are inclined to be easy. It is only sometimes that they will make the order. They will do so if the majority present is in favour of waterclosets, but if the majority present of the board is in favour of letting things alone the cesspool is ordered to be cleaned out by the inspector of nuisances at the cost of the parties. That is all that is done.

14,636. Has an improvement taken place in this respect since the board was established, and are nuisances removed from the town more effectually than they used to be?—In perhaps 300 out of 1,100 houses there will be waterclosets and a proper water supply for the closets. Of the remaining houses some are better and some are not better, but the town is kept in a cleaner state than it used to be. At the same time it is nothing like what it ought to be.

14,637. Do you find that there is any improvement in the comfort and health of the inhabitants in consequence of the steps you have taken?—I have no means of ascertaining. No return is made for the town alone.

14,638. What is the district for which the registrar makes his return?—Skipton Union I should think, but the registrar will be able to explain that.

14,639. Where is the sewage discharged?—Below the town, just above the railway. The volume of sewage will be 100,000 gallons a day, and we mix that in the sewers with another 100,000 gallons of water, clean water, arising from springs, which are met with in the course of the works.

14,640. Has the board taken into consideration the propriety and utility of passing that sewage on to land?—We have talked about it, and we have had a report made as to what can be done, but the cost of doing it stands in the way at present.

14,641. Is there any difficulty in obtaining land?—We do not know, but I think the difficulty will be in obtaining money. Of course we could obtain it, but then we should have to pay it back again by a rate, and as long as we cause no particular nuisance the board do not wish to incur the expense of doing anything with the sewage.

14,642. What is the rateable value of the property within your district?—7,000*l.* and some hundreds upon houses; not quite 2,000*l.* upon land.

14,643. Do the houses include the mills?—Yes, and all property which under the Act of Parliament is called a house.

14,644. Are you aware that sewage of towns is applied now in many cases, and with advantage, to land?—I have seen an account of what has been done at Croydon and Rugby and other places, and the evidence that has been given in Parliament upon the London question, and other papers on the subject I have read carefully over.

14,645. What conclusion did you arrive at?—I do not think that there is any nuisance here yet, and for this reason; 20 grains of organic matter and inorganic matter in suspension, and 20 grains of inorganic matter in solution, with 2 grains of organic matter in solution will be the state of our sewage. We turn that at once into 4 times the quantity of clean water, and the whole goes one mile with a fall perhaps of 14 inches in the mile. It then enters the river Aire, and goes 10 or 12 miles without a house near it, so that the organic matter must be oxidized and matter in suspension must be all deposited before it gets to the end of the 12 miles; therefore we do not put more than 4 grains of matter to a gallon into the

river at present. It will of course be a greater quantity when all the houses are connected with the sewers.

14,646. It is merely a question of degree. You are fortunately situated in having an abundance of water with which to dilute the sewage.—That is not all; we have also land on which we could put it, but the cost of the necessary works to get it there and preparing the land for it would be too great to incur while we are paying off the money borrowed to make the sewers. It would be too heavy a charge on the population, and therefore we think it better to avoid it as there is no nuisance to complain of yet.

14,647. Are you aware that some towns lower down are obliged to take their water from the river?—I do not know that any but the town of Leeds has ever done so. Bradford is otherwise supplied. Below Skipton there is no town on the river until you get to Bingley, and there could not be on account of the floods to which the river is liable.

14,648. Still there is a large population as you go down the river, and of course if the sewage from all the towns and villages situated on the river proper and upon the becks is turned into the river, the river must be polluted very seriously.—I agree with that, and that the sewage ought to be kept out of the river, and that where it was possible, a town population ought to be obliged to bear the expense; but I think that in a case like ours, time ought to be given, for it is a very serious expense to make sewers. Afterwards, when the money has been recovered, and the debt paid off, I think we might fairly be called upon to put the sewage on to the land, but even then all matters in solution in the water, which now contains 20 grains to the gallon, would still go into the river.

14,649. Not after the sewage was passed over the land?—No. In the Croydon report it was stated that they could not, under any circumstances, when they had passed the sewage four times through the land in Croydon, effectually extract the matters in solution At Rugby this was the case to a still greater degree.

14,650. But sewage is changed in character by being passed over land; what was noxious becomes innocuous.—Phosphorus and some other salts are taken out; but here a large quantity of iron and lime would be thrown into the water from any land that we could pass our sewage through.

14,651. You say that it is necessary to make towns keep their sewage out of the rivers and becks. If so, you could not expect that Skipton could be made an exception to the general rule.—Every private house in this neighbourhood sends filthy water into the first stream that is nearest to it. I suppose that the practice is the same throughout the whole country, and that all the villages and towns do the same; but a great deal of the matter is oxidized, so as not to be injurious by the time the liquid reaches the next dwelling-house. There are cases where single houses pollute the water for those next below them, and that ought not to be done no doubt.

14,652. Single houses must be treated in the same way as towns?—Yes. There are members on our Board who would be glad, when they could raise the money, to do something for sewage irrigation.

14,653. What other kinds of pollution are sent into the beck?—The nearest works to the mouth of the sewer are dyeworks. There are tan and lime works a little further on beyond the dyeworks, and then there are paper mills and slaughter houses, the refuse from which of course is collected into our sewers in a great measure before it is discharged at the mouth of the sewer.

14,654. Is not the blood from the slaughter-houses utilized?—It is carried into the sewers at the present time. The refuse is carted away on to the land for manure, but the liquid matter is turned into the sewers. I do not attend except merely to the general business of the board.

14,655. Is there any further information that you can give us?—With regard to the works carried out by the board of health, I know nothing more. There is land fit for sewage irrigation, but unfortunately it is the best meadow land, which we should have to take at a large price. We have no sand, but plenty of clay, and all the works would be expensive though we should not have to pump the sewage.

14,656. Could you put the sewage on to the meadow land without pumping?—Yes; by carrying it in sewers, and providing proper means for taking out the heavy materials, and carrying it a distance of $\frac{3}{4}$ of a mile.

14,657. (*Professor Way.*) Are you aware, from your reading on these subjects, that the better the land, the greater will the increase of produce be from the application of sewage?—Yes; but the less will be the profit. If you can get land at 5*l.* an acre and let t at 20*l.* an acre, good; but if you have to take other and at 5*l.* an acre and let it at 20*s.* an acre, you have lost 4*l.*; and here, if we take land at 4*l.* an acre and let it at 5*l.* an acre, we should not be better off than they are at Croydon.

14,658. Supposing the land produces crops equal in value to 30*l.* or 40*l.* per statute acre, undersewage, would the prime cost, whether it be 3*l.* or 5*l.* or 7*l.* be a serious item in the whole return?—I am no farmer, and have had no experience. I merely go by the report of the Croydon board. They said they paid 4*l.* an acre for 300 acres of land and that they let it with the sewage to Mr. Marriage at 5*l.* an acre. If they could get 20*l.* an acre they would do so.

14,659. Are you aware that the Croydon Local Board will decline in all probably to let that land again upon the same terms when the lease is ended?—I do not know that; I have not seen anything to that effect. The land at South Croydon is valuable land. It is tolerably stiff clay, which produces as good, if not better, crops than the land which Mr. Marriage has. Clay is the best purifier of sewage if you have plenty of land to lay it on. I consider that our sewage is not one-half the value of the Croydon sewage, that is to say, if the Croydon sewage is worth a halfpenny a ton, ours is not worth a farthing, on account of the larger quantity of water as compared with the quantity of sewage matter.

14,660. But the proper way of estimating the value of sewage is by the number of the population, and not by the extent of the dilution it undergoes?—Yes.

14,661. Consequently, if there are 5,000 in a population, you know at once what the value of the sewage is, independently of its dilution, and if the sewage is not to be pumped, the gross amount of dilution is not an element in the question at all?—The population of Croydon was reported in the account that I saw to be 15,000, and there was delivered 200,000 gallons of sewage per day. We turn into the brook on the dryest day 200,000 gallons, with a population of only 5,000, and if I were to say that our sewage was worth only one-third of the value of the Croydon sewage, I should not be, I think, under the mark. I take it that one-half of what is delivered from our sewers is water alone.

14,662. If you had not to pump it it would be quite easy to distribute it, and more easy to distribute a large quantity than a small quantity?—Yes. Still you have to put it on to the land. Our rainfall is 34 or 36 inches in the year. Croydon has probably half of that, and therefore, if we have 3 feet of water on the land in the shape of rainfall, and we have 9 feet more to put on in the shape of sewage, that makes a depth of 12 feet for the total quantity of liquid that we should have to filter through the land, and that would be a serious nuisance in the winter time unless we took a large quantity of land for irrigation.

14,663. There may be a difficulty in the case, but it is clear that the difficulty might be overcome?—Yes, at an expense. We do not dispute that it can be done by incurring expense. We have had plans prepared of the land, levels taken, works laid out, and an estimate formed, therefore I do not speak in the dark upon the matter. Still it would be a serious expense to us. We should want a tenant capable of working the water meadows.

14,664. (*Mr. Harrison.*) Have you observed the

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works which have been carried out in improving the river Aire between Skipton and Keighley?—I have seen parts of them as I have gone down the valley, but I have not taken much notice of them, except those close to the town.

14,665. Have those had a beneficial effect?—Yes, there is much less water now in the valley in a time of flood?—Our brook which we call the Ellar brook, which comes through the town, used to discharge into the river Aire, three quarters of a mile higher up than it does now, and in that three-quarters of a mile there is a fall, perhaps of 10 or 12 feet. Now it is carried in a straight line lower down the river, and the fall is taken up by two weirs at once, so that the brook runs in a perfectly straight line at once into the river and in consequence our valley has much less water in it in a flood.

14,666. Has any improvement taken place in the health of the people consequent upon the diminution of the floods in this neighbourhood?—I cannot say.

The witness withdrew.

Mr. R. H. Sidgwick.

Mr. Robert Hodgson Sidgwick (Skipton) examined.

14,667. (*Chairman.*) Are you a resident here?—Yes.

14,668. Have you resided here for many years?—All my life.

14,669. Are you engaged in manufactures?—I am.

14,670. In what part of the town?—Close to the Leeds and Liverpool canal and near the railway.

14,671. What business do you carry on?—Cotton spinning.

14,672. Was that business affected by the American war?—It was; seriously.

14,673. Has it revived since then?—Yes; for periods, and then it has lapsed again; the markets have fluctuated.

14,674. Do you use water or steam power?—Steam power to the extent of 40 horse.

14,675. What price do you pay for coals at Skipton?—The price of coals has been raised lately, what we term slack or small coal from Leeds, costs us about 7*s.* 9*d.* or 8*s.* per ton. the small coals from Leeds are about the same now, they were cheaper. The unriddled coals cost from 10*s.* to 11*s.* a ton.

14,676. How many years has the railway been opened to Skipton?—I think it was opened in 1847 or 1848.

14,677. How long has the canal been opened?—Since 1789 or 1790.

14,678. Did you derive any advantage from the formation of the railway in the price of coals?—It is so long ago that I cannot speak to that; I have no doubt that we did.

14,679. Did you employ steam power before the railway was made?—Yes; our mills lie by the canal which still brings coal, we principally get coals by the canal.

14,680. What do you do with the ashes?—Anyone who wants ashes for paving or for building purposes fetches them, the rest we send down the canal in a boat, and put them on the banks.

14,681. You do not turn any of the ashes into the beck?—We have none near us.

14,682. Do you send any refuse from the manufactory into the beck?—No.

14,683. How do you manage with regard to privy accommodation for your hands?—The refuse is all passed into a tank, and then it is carted away by people in the town, and taken on to land.

14,684. How many hands do you employ?—From 280 to 300.

14,685. Did you hear the evidence given just now by your brother?—Yes.

14,686. From your own knowledge can you say that he has described pretty nearly the existing state of things?—He is better informed upon the matter than I am, and I think he is pretty correct.

14,687. Can you give any evidence with regard to the fouling of the stream here?—No,

14,688. Are you at all affected by its being fouled by other persons?—No, not at all, personally we do not pollute the stream. My brother mentioned correctly that there are certain persons who turn all their waste water into the beck.

14,689. Where are the paper mills?—They are higher up the same stream.

14,690. Above the town?—Near the castle, that is, on a line with the castle.

14,691. Is there much pollution or objectionable matter sent from the paper mills into the river?—I should say not. I never heard it mentioned as a nuisance. No doubt they do turn out their waste, but I never heard it complained of.

14,692. Are there any fish in the beck here?—I am not prepared to say.

14,693. Are there fish in the Aire?—Yes; very good trout, I believe. The Aire for some miles below the entrance of the Skipton bed has been preserved for 20 years, and is, I believe, still preserved.

14,694. Do you agree with your brother that if any measure is passed calling upon the towns below to keep their sewage out of the rivers and becks Skipton should be obliged to follow the same law?—I think it is evident that it would be for the benefit of the country at large to keep the streams quite pure, but I think other nuisances might arise from sewage irrigation.

14,695. Are there any pollutions in Skipton, such as cause an objectionable nuisance to the inhabitants?—I do not know of any.

14,696. No bad smells arising from them?—In the summer time there are bad smells arising from the brook, but that is partly caused in this way. There are mills situated higher up the stream, and the small supply of water that comes down in the summer months is reserved in the dams above. There is a bad smell from the brook in a summer's evening.

14,697. From what mills is that refuse sent down?—I am speaking of the brook generally below the town. After you pass the railway the smell might be observed, but that is below the sewage outlets of the whole town.

14,698. (*Professor Way.*) The quantity of water flowing down the two becks below Skipton is very considerable?—Yes, at times.

14,699. Your population is only 5,000?—About that.

14,700. You have here a comparatively small amount of impurities in the river and a large quantity of water to dilute those impurities?—I think so.

14,701. You are therefore very favourably situated?—Yes.

14,702. But you would admit that it would not be fair to take your case as an example of the state of things which exists throughout the whole course of the rivers Aire and Calder?—I think not. As I was saying, when the water that comes down the stream in the summer months is reserved in the mill-dams the smell during the evening is bad, because there is a very small quantity of water to dilute the sewage and other impurities; otherwise there is no nuisance perceived at any time by the side of the brook.

14,703. You are aware that when that state of things is aggravated, I mean when the quantity of impurity is a larger proportion of the volume of water, a serious nuisance arises?—Yes; for instance, the beck at Bradford or the river near Leeds.

14,704. It is a question of principle. If in one case it was said that a nuisance was so small that it might be allowed to pass unnoticed what law could you introduce to meet other more serious cases?—I think that one general principle ought to apply to all cases.

14,705. You think at the same time that all proper indulgence should be given to this as to other towns which have difficulties to surmount?—Yes.

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14,706. But the evil is an evil be it ever so small?—Yes, it is the commencement of an evil which will naturally grow worse.

14,707. It might be said that the evil is at the beginning of the streams that feed a river, and that the evil grows worse and worse the lower you come down?—Yes.

14,708. Any reasonable measure, either for towns or manufactories, which should be devised you at Skipton would be just as ready and willing to comply with as other towns would be?—Yes, I think so.

14,709. (*Chairman.*) How is the town supplied with water?—By waterworks from a hill above the town. There are two reservoirs on that hill.

14,710. Do you manufacture only white calico?—Yes, except that we weave a little for Bradford occasionally.

14,711. You do not dye or print?—No.

The witness withdrew.

Mr. JOHN HEELIS (Skipton) examined.

Mr. J. Heelis.

14,712. (*Chairman.*) You are the son of the clerk to the board of health?—Yes.

14,713. Your father has been clerk I believe since the formation of the board?—Yes.

14,714. Did you hear the evidence that was given by Mr. Sidgwick, senior?—Yes; at least I heard the greatest portion of it.

14,715. He gave the population at 5,000, and the rateable value of the district as 7,000*l.* from houses and 3,000*l.* from land?—Yes.

14,716. He also gave information as to carrying out certain works. Was all that correct?—Yes, as far as I know it was perfectly correct.

14,717. Upon what other points besides those he touched upon can you give as any information?—I do not think I can give you any other information, but I will hand in a copy of our byelaws (*handing in the same*). We are under the Local Government Act.

14,718. Are many new houses being built?—There have been a good many new ones built, not large houses, but small houses for the manufacturing population.

14,719. What steps are taken by the board when new houses are being built?—Before any new buildings can be erected all plans are obliged to be submitted to the board of health, and to be approved by the board beforehand.

14,720. What arrangement does the board require to be made as to privy accommodation or waterclosets?—They require waterclosets to be made to the new houses, but existing privies are not directed to be altered unless they become a nuisance. When they are found to be a nuisance an order is made that they shall be turned into waterclosets.

14,721. Has that been carried out to any considerable extent?—Yes.

14,722. (*Professor Way.*) Have you power to suppress nuisances caused in the streams?—No.

14,723. Supposing that any factories were to be erected here which seriously affected the streams, should you have any power to prevent any nuisance that might be caused by them?—No, except by preventing the erection of the buildings altogether. We have that power because no building can be erected unless the plans are submitted to the board and approved. If the drainage was likely to pollute any stream and cause ill-health then the building would not be approved.

14,724. You think that you would have power under the provisions of the Act to prevent any building being erected that might cause a nuisance?—Yes.

The witness withdrew.

Mr. JOHN SCOTT (Skipton) examined.

Mr. J. Scott.

14,725. (*Chairman.*) Do you reside in Skipton?—Yes.

14,726. How long have you resided here?—22 years.

14,727. Have you carried on business in Skipton?—Yes, I am a brewer.

14,728. Have you carried on that business during the whole period of your residence?—Yes.

14,729. What water do you use for brewing?—We have waterworks of our own for brewing purposes, and we use the canal water and the brook water for rinsing and such things.

14,730. Do you use steam power?—Yes.

14,731. To what extent?—10-horse.

14,732. What do you do with the ashes?—We lead them away in all cases.

14,733. What volume of water do you use for brewing independently of cleansing and what you use for steam power?—I cannot tell you the number of gallons, but I can tell you the quantity of malt that we brew.

14,734. In cleansing your casks and other vessels what becomes of the refuse?—It is turned through our drains into the Ellar beck, which is a tributary to the river Aire at a distance, I think, of a mile or more from the river.

14,735. Is that refuse of an objectionable character?—No, I think not from the brewery. It is pretty sweet sort of stuff. I think there is no bad smell with it.

14,736. Do you send any spent materials from your brewery into the beck?—None at all. We collect all the rinsings from the mash-tubs and spent hops for manure. We collect them in our middens. The grains of course go into the country for stock.

14,737. What is the name of the beck that passes through Skipton?—It is called the Ellar beck.

14,738. And your works are situated upon it?—Yes.

14,739. From what source do you obtain your water for brewing?—We have a watercourse from a place called Skibeden Springs, and we collect the water into a tank that we have provided.

14,740. Is it soft water?—No, hard water.

14,741. Are the springs in the limestone?—Yes, and we collect two or three springs into one tank, and so bring the water down.

14,742. Is the water of the beck hard or soft?—The Ellar beck water varies very much, but it is soft water.

14,743. What is the character of the water that is supplied to the town?—I think it comes partly from limestone and partly from millstone grit.

14,744. How many hands do you employ?—11 or 12.

14,745. What do you do with their excrements?—We have one privy for the men, and the refuse goes into the horse and pig midden, it does not go down the beck, it is taken on to the land along with the manure.

14,746. The only pollution that you cause in the beck is from the washing out of the casks?—Yes, that is all; we lead all the solid refuse away in every case, and always have done so.

14,747. Would there be any great objection to your taking even the other refuse away and putting it on the land, or passing it into a sewer, and so that it might be conveyed to the land with the sewage of the town?—I think that the refuse from the brewery would not be worth anything as manure. We have a very large supply of water, and we use it all.

14,748. Is the water of the brook so polluted that you could not use it for brewing purposes?—No, it is clear water with us, or moderately so.

14,749. (*Professor Way.*) Is soft water suitable for brewing?—No.

14,750. Does it make the beer too dark?—No; but it gets too much out of the malt, it gets thick.

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14,751. I suppose you cannot brew pale ale with soft water?—No, not to be very good.

14,752. Do you know how hard the water is that you use?—I do not know that exactly, but we sent it up to Leeds to be analysed, and the report that we received was that it was very similar to the Burton water.

14,753. (*Chairman.*) I believe you know something about the land below the town?—I only farm a very small quantity of it.

14,754. To what extent do you farm?—Only about 4 acres in the valley.

14,755. Do they lie on the border of the River Aire?—No, they are at a good distance from both the river and the beck.

14,756. Is that land subject to flooding?—It is never flooded.

14,757. Have you observed, that land which was formerly subject to flooding is now not so much so?—Yes.

14,758. Has that exemption from flooding been beneficial?—We consider so.

14,759. Has there been an improvement in the health of persons residing near to the land that was formerly more flooded?—I do not know that.

14,760. Was there much fever among the people formerly who lived upon the low grounds?—There is no population near the places which were flooded, no houses.

14,761. (*Professor Way.*) If the water does get to the land, I suppose you would endeavour to regulate it as to when it should come, and when not?—Yes.

14,762. Are any arrangements made, any embankment constructed, or any improvement of the river below for the purpose of irrigating the land?—I do not know.

The witness withdrew.

Mr. W. Graham.

Mr. William Graham (Keighley) examined.

14,763. (*Chairman.*) I believe you are a member of the local board of Keighley?—Yes. It was thought by our board that you had not received sufficient information as to the waterclosets at Keighley, and a deputation of gentlemen in the town called upon me, as I had been a member of the board, and expressed a wish that I should come to give you further information. I have now obtained that information, and with your permission I will give it. I may state that we have a strong impression that there is no use for waterclosets, that they are a great nuisance in every place, and very injurious to health. We think that they can be dispensed with altogether. I have brought with me a list of the persons who use waterclosets, and of those who do not. A great many of them use the sewage for the land and take it direct from the factories, they do not put it into the water at all, while others will do so, whether the board like it or not, we have endeavoured to stop them. We have never passed a plan, I believe, since the board commenced its operations, with waterclosets in it, and there is a very strong feeling against their use on the part of the Board of Health.

14,764. Nevertheless are there not a number of mills at Keighley which have waterclosets attached to them?—Yes, I believe there are some, but a number of them have not any, there are only a few that have waterclosets.

14,765. Is not the refuse collected at a number of them, and sent out into the country to be applied to the land?—Yes; they have tanks or barrels with wheels, and they wheel the refuse away, it is taken and laid up, and covered with soil, and then the compound is used direct for the land. I have a list here of the names of the persons by whom it is dealt with in both ways.

14,766. How many hands may those who use waterclosets employ, and how many hands do those who carry away the refuse in any other manner employ?—I cannot say exactly, but I believe there are as many who do not use waterclosets as do.

14,767. Do you think that the number of hands employed in each case is the same?—I think that those who do not use waterclosets probably employ the largest number of hands.

14,768. Your board seem to entertain the idea that the use of waterclosets is prejudicial to health?—Yes.

14,769. In what way would it be prejudicial to the health of people who are employed at mills?—In this way, the waterclosets are emptied into the beck, and there are dams down below, and those dams become stagnant for a time. Then there are waterwheels, and those waterwheels are constantly turning in this filth and dirt, only this last summer persons from some mills came to me, as being one of the Board of Health, and wished me to interfere to improve the condition of the water; and the overlooker said that the workmen in warm weather were going out of the mills sick, that filth would sometimes flow down so as to sicken any person. Again the sewage fills the lodges at the dams, and these sometimes are flushed out, perhaps once in a week, and then the stench is awful. We consider that this is a great cause of pollution.

14,770. Have you any evidence to prove that illness is caused by the sewage collected at these mills?—No. We have no evidence that I am aware of to show that there is any evil connected with the mills from collecting their own sewage in cases where it is taken away on to land.

14,771. I mean at those mills where the dams are?—I cannot speak upon that question, but people do complain very much of what I have described, and they consider it a source of discomfort. They say that sometimes they cannot stand it, and that they must leave the place altogether in the summer time.

14,772. That proves that it is necessary for your board to find some land to which to apply the sewage by irrigation?—We think that this can be done: that everyone can find for himself people who will be ready enough to take this material, if they can get it without ashes. On the other hand, we cannot find land in the neighbourhood. No one will sell his land there.

14,773. Some evidence was given at Keighley as to the number of waterclosets in the town; have you any further evidence to give?—I believe that upon the south beck there are 41 waterclosets connected with mills and two belonging to cottages, making in all 43. Then on the north beck there are in mills 10, and in cottage houses there are six, all emptying into the beck.

14,774. What number is there altogether?—I think about 59. Then again in private houses we have 44, which empty direct into drains, and which are supplied from our waterworks. There are a good number of houses in the town independently of these where they use cesspits. They do not, I believe, use our water.

14,775. How are the cesspools cleansed?—I do not know.

14,776. Is there any overflow from them into your sewers?—No; in that case there is not. We do not let the liquid come into the drains in that kind of way if we can help it.

14,777. Are ashpits numerous in Keighley?—Yes, I should say there is a great number.

14,778. Has your board taken steps to prevent their becoming a nuisance to the persons living near them?—Yes; we employ an inspector of nuisances, and when he sees anything of that kind, if the parties do not remove it, we cause it to be taken away, and charge the people with the cost. The inspector gives them notice that the nuisance is to be removed within 24 hours.

14,779. Have you found that the health of the inhabitants has been at all improved by doing this?—I do not know that we have; public health varies very much, and I cannot speak exactly on that question.

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14,780. Within your knowledge have there been parts of the town where disease has been more prevalent than in other parts?—Yes.

14,781. Where are those districts situated?—Generally in the higher districts.

14,782. Is there any cause to which you can attribute that greater liability to sickness?—I have asked medical men often, and I never could ascertain what the reason was, there is generally most fever on the hills.

14,783. Are the sewers carried up to those high places?—No.

14,784. Are they properly ventilated?—In many cases there is a current of water that runs through them.

14,785. But are means provided to enable the gases to pass away?—No.

14,786. Are you aware that if a system of sewerage is carried out without proper ventilation, you are very apt to remove the cause of fever from the lower part of the town which was badly drained before, and where probably cesspools were numerous, to the upper parts of the town by the foul air rising up to them?—Yes; but the places I have alluded to pass the sewage direct into the beck, and by very short drains, one of them is not more than 100 or 200 yards right down, and the incline is very great. In another case the drains are perhaps not more than 200 or 300 yards long. I should mention that in the neighbourhood for 5 or 6 miles round Keighley, there is more fever on the hills than in the valley.

14,787. Are the houses where fever prevails inhabited by persons in the better condition of life?—We have had it both ways, we have had fever at different times in some of the very first-class houses in the neighbourhood, at the late Mr. Marriner's for instance.

14,788. In the cases that you have been acquainted with have you found cesspools in connection with waterclosets?—They do not use cesspools that I am aware of, they let the sewage go into the beck, if they use waterclosets at all.

14,789. In the houses situated as you have stated on the side of a hill is it customary to have ashpits below the floors of the houses?—I should say not, as a rule.

14,790. In passing last night from Keighley to Cullingworth we saw a number of ashpits placed under the sleeping rooms?—I am not aware that that is so as a general rule in the country.

14,791. But is it not the fact that there are such places?—Yes; there are such cases, but not many.

14,792. Do you not think that ashpits so situated below rooms in which people sleep are likely to give rise to fevers?—I cannot say; I cannot understand fevers in that part which you allude to, it is not subject to fevers. In the opposite direction there is a space of about a mile square, it is on the south-side of the town, and the registrar has informed me that he has had more cases of fever there than in any other place in our district. I have the facts to which I have spoken here in these papers (*handing in the same*), but I cannot give you any reason. The lower part of the town below the railway when we had fever so bad is all well drained now, and in those localities we have less fever than in any other part of the town.

14,793. Are you aware that some cellar dwellings in Keighley were flooded the other day, and that the people were obliged to turn out?—Yes.

14,794. And that the liquid which flowed into those cellars was very objectionable and smelt badly?—Yes.

14,795. I believe steps have been taken, by whitewashing, in some degree to mitigate the evil?—Yes; but the parties are doing it themselves, we do not do it.

14,796. Do you think that dwellings liable to be flooded as these were with this objectionable matter, can be fit habitations for human beings?—I mean to say that the people will take the best steps they can themselves to do what is necessary without any sanitary body interfering with them, in many cases of this kind the people have friends in the town, and until they get their houses into a purified state they will not attempt to live in them, not the better class.

14,797. Have not some already returned to these cellar dwellings?—I have not heard of that.

14,798. Do not you think that it is very likely fever will break out in consequence of these people returning to their cellar dwellings?—I cannot say.

14,799. Would it not be a proper thing for the board to take cognizance of this state of things, and inquire of the medical officer how far it will be safe for these people to return to their dwellings until they are properly dried?—There are not so many houses in this condition. The greatest amount of filth that we have is caused in this way, some manufacturers and builders of cottage houses are narrowing the beck continually, and this raises the level of the water. I know of some houses which have been flooded just now to a serious extent, and the people have been obliged to go out altogether, they were 3 or 4 feet deep in water, formerly it was not so. The beck has risen several feet since I first knew it, perhaps 3 or 4 or 5 feet in places; where the beck has been so narrowed, the water rises higher than it did formerly, when it was not so liable to flood cellars, and other property in low situations.

The witness withdrew.

Mr. John B. Dewhurst (Skipton) examined.

Mr. J.B. Dewhurst.

14,800. (*Chairman.*) Are you resident in Skipton?—Yes.

14,801. Do you carry on any manufactures here?—Yes; cotton spinning, and cotton and worsted manufacturing.

14,802. Where is your manufactory situated?—At the outskirts of the town, on the Ellar beck below the town.

14,803. How many hands do you employ?—About 640.

14,804. Is that as many as you have been in the habit of employing for years past?—Yes.

14,805. How long have you carried on business here?—For nearly 40 years.

14,806. You were affected, I suppose, like many other manufacturers by the war?—We did occasionally run short time.

14,807. Did you find that many of your workpeople left you?—No.

14,808. Do you carry on any dyeing?—Yes; we dye our own warps, such as are required to be dyed.

14,809. What becomes of the refuse from your dyeworks?—The liquid refuse goes down the beck.

14,810. What becomes of the solid refuse?—The bulk of it is carted away with the ashes from the fires.

14,811. Do you chip your dyewoods?—The logwood is generally rasped, but I believe it is chipped now.

14,812. The waste chips you say you collect and send out into the country?—Yes; at least it is thrown into a heap with the ashes.

14,813. Do you think you would find any difficulty in purifying the liquid before you send it into the beck?—I think we should; I do not see how it could be purified. If it is sent into a tank to deposit, it only deposits solid matter, so that what is injurious would go forward still.

14,814. Mr. Townend, who was examined at Keighley, stated that he passes all his dye water on to a heap of ashes from his mill, about 18 feet in depth; that the dye water percolated through those ashes, and passed away pure?—That I think we could easily do; any means that can be adopted we should be glad to adopt; it is a plan that we have thought of trying.

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14,815. If you found that such purification could be carried out without trouble or much expense, would you be willing to adopt it?—We should be willing to adopt any means.

14,816. Is any other refuse sent from your works besides what you have mentioned?—From two-thirds to three-fourths of our premises is accommodated by waterclosets, which are connected with the beck. As to the other part we have a tank, and the night soil is carried to the land.

14,817. Would it be very burdensome to you if you were obliged to collect it all and send it into the country to be used on the land?—It would be difficult to do so; but if we were obliged, we should of course do it.

14,818. How much coal do you use in a year?—About 3,000 tons.

14,819. What do you do with the ashes?—They are carted away for various purposes; none are passed into the beck, nor have been for the last 12 months, and it is not our intention to let any more pass in.

14,820. What horse power do you employ?—The nominal power is about 120 horse.

14,821. Do you use any water power?—Not here.

14,822. For dyeing purposes where do you get water?—From the beck.

14,823. Is it polluted before it comes to you?—No; we have no fault to find with it.

14,824. After you pass your refuse into the beck from the dye works, would the water be fit for another manufacturer situated below you to use?—Yes; because there is much more water in the beck than we require to use, even in the driest time.

14,825. Still the character of the refuse that you throw in is, as far as it goes, objectionable?—Yes; but it is so minute. I have just reckoned up the quantity of dye stuffs that we have used during the year, logwoods, and other dye woods, shumach, gambier, sulphate of copper, and sulphate of iron, it amounts altogether to about 60 tons.

14,826. (*Professor Way.*) How many dye vats have you in the mill?—They are all for dyeing warps; we have a set for dyeing black, and a set for dyeing colors. We do not employ more than about eight or nine men and lads in the business.

14,827. Then you do not discharge a very large quantity of spent dyewater into the beck?—No; the waste liquid from logwood is almost colourless when it leaves us.

14,828. And that is discharged into a large volume of liquid?—Yes.

14,829. The quantity being small would be easily dealt with?—Yes, all these things are diluted with water.

14,830. Do you dilute when you are running off the logwood vats?—Yes, the liquid runs through two or three logwood vats, becoming weaker and weaker, and it runs away from the last vat of a very different colour from that in the earlier vats.

14,831. Still the liquid is used over and over again in different vats, and then it is ultimately discharged?—Yes, it is discharged when it is so weak that we cannot use it any further.

14,832. Is not that liquid dark?—Yes; but you may say that in each vat it gets lighter; it is not darker than dark vinegar as it comes out of the last vat.

14,833. Is there not some solid deposit in it?—No, the chips have all come out in the preparing and boiling process.

14,834. You are speaking of the dye vats?—No; the preparing and boiling to extract the colour are done in a separate vessel where the solid matters are deposited.

14,835. Does not a mixture of sulphate of iron and bi-chromate of potash produce the colour?—Sulphate of iron and logwood are used in different compartments of the same machine or dye vat.

14,836. Is not the mixture of the two the cause of the black colour?—The liquid is black before the logwood is applied to it.

14,837. Is any of that black colour produced outside as well as inside the warps?—In the fibre.

14,838. It is all equally coloured through the warp?—Yes.

14,839. (*Chairman.*) In dyeing a certain quantity of dye is fixed in the warp, is there any dye upon the exterior surface of the warp that is liable to be washed away afterwards?—Yes, there is always a little.

14,840. (*Professor Way.*) That is the dark matter which causes the dark colour of the water of the Aire and Calder lower down?—Yes.

14,841. Apart from the question of purity, the colour of the water in the river undoubtedly is derived very largely from dye refuse, is it not?—Yes.

14,842. The question is whether that dye refuse is in solution or suspension?—I should have thought that it was in solution, subject to your correction.

14,843. If it could be kept out of the streams, I suppose the appearance of the streams in point of colour would be considerably improved?—Yes.

14,844. (*Chairman.*) What weight of cotton do you manufacture in the course of a week?—From about 8,000 lbs. to 9,000 lbs. weight of cotton at this mill.

14,845. (*Professor Way.*) Is that dyed with mordant?—Yes; shumach is, I presume, the mordant.

14,846. Do you use lime at all?—Yes.

14,847. Can you state the quantities that you use?—Yes; I have an account here (*handing in the same*). In the items of lime and chloride of lime; the larger item is lime, unslacked lime, the smaller quantity is chloride of lime.

14,848. For what purpose do you use lime?—It is used in the dyeing of black. I do not know what it does.

14,849. At what stage of black dyeing is lime put in?—It comes in after it has gone through the shumach. So far as the lime is concerned, the solid matter is put into cisterns and goes on to the land; only a portion of the lime water will go down the stream, and that is very fully exhausted; lime fixes the colours.

14,850. (*Chairman.*) Is your yarn sent chiefly into the worsted districts?—Yes, to Bradford, and it is exported for the same purposes.

14,851. Do you print at all?—No.

14,852. Do you produce any of the brighter colours, any of the aniline dyes?—Yes, but only a very small quantity; whatever dyes are required of us we produce.

14,853. Is the water you use suitable for aniline dyes?—Yes.

14,854. I suppose you can produce a better scarlet than they can at Leeds?—Yes; I should say so.

14,855. By using the water of the Aire?—Yes.

14,856. It is an advantage, is it not, for bright colours to have a fine soft water?—Yes.

14,857. But the colour is of greater importance than the hardness of the water?—Yes, I should say so, in delicate light colours.

14,858. Supposing you had to produce a scarlet, or mauve, or violet, with a water in which there were black particles suspended, could you do it?—I should think it would be impossible to produce passable colours.

14,859. How long have aniline dyes been employed here?—We have only dyed here in the last two or three years, and we have not used the aniline dyes for perhaps more than 12 months.

14,860. Do you use any cochineal?—I believe not any.

14,861. I suppose you would not be surprised to hear that for the brighter colours the trade has been removed towards the sources of the streams in order that dyers might get purer water?—No.

14,862. Nor that in Leeds, unless by using the water brought in by the companies, they can hardly produce the best colours?—No; I think it is very likely to be so.

14,863. Pure water is not so important in the case of blacks and blues?—No, nor in dark browns.

The witness withdrew.

Mr. William Bradley (Skipton) examined.

14,864. (*Chairman.*) I believe you are a surveyor to the local board of health here?—Yes.

14,865. How long have you held that appointment?—Since November 1858.

14,866. Has a system of sewerage been carried out whilst you have been surveyor?—Yes.

14,867. Who reported upon it?—Mr. Curlew.

14,868. Has it been carried out in accordance with that report?—Yes.

14,869. When was it completed?—I believe in 1860.

14,870. Are the houses in Skipton connected with the sewers?—Yes; a great part of them, I may say nearly the whole, are connected; but the drains are not all laid down. The stone drains are connected in many places with the main sewers.

14,871. Do you mean that there is not a direct connexion between the houses and the new sewers?—There is in the case about 100 houses.

14,872. In other cases are the old drains connected with the sewers?—Yes.

14,873. What number of waterclosets are there in Skipton?—About 100.

14,874. How many ashpits and privies are there?—I should say about 200.

14,875. Does your board encourage the conversion of privies into waterclosets?—They have done so.

14,876. Where privies have been so converted, has there been any improvement in the health of the people?—There has.

14,877. What direct information can you give us upon that point?—I have had it from the parties themselves who use waterclosets, that they have been a great benefit to them; the benefit has been evident, we have had many privies turned into waterclosets, and by doing away with the nuisance, health and comfort have been improved.

14,878. You believe that the general health of the people residing in these houses has been improved?—I do not say anything about health, but comfort.

14,879. In these cases were the ashpits and privies immediately adjoining the house?—Yes, in many cases they were reported to the board as a nuisance by the inspector.

14,880. Were they sometimes within the house itself?—No, I do not recollect any one being in the house.

14,881. When new buildings are erected, do you take steps to have privies or waterclosets built according to some rule?—We require waterclosets to be built except in cases where there has been no main sewer, and then we have been obliged to allow privies to be made.

14,882. Can you state what the death rate in the parish of Skipton is?—No; Mr. Bailey will give that evidence.

14,883. What are your general duties as surveyor to the local board of health?—I have the management of the highways, and I am collector of the rates. I have also to look after all buildings; the plans come to me and I keep them, and see that they are carried out. I have the management of all the sewers; and the main sewers are flushed out once in every week; we have flushing wells at the heads. We get the water for flushing some of the sewers from the water company, and for flushing other sewers from the milldams; it is turned into the sewers from a well which holds 600 gallons, and we send it all down at once.

14,884. Is there much foul gas in the sewer?—There was foul gas at the two ends of the sewer, and I hung a door with hinges which could be raised up and down by the water, for the wind, when it was in the west, blew up the sewer, and the air of the sewer smelt very badly at other times. The engineer had left all the gullyholes trapped, and when the sediment was taken out, the water necessarily was lowered in the gully, and then came up the foul air. I have taken many of those out, and caused a direct communication from the gully into the sewer.

14,885. Have you found a decided benefit from opening the ends?—Yes.

14,886. Are the sewers ventilated?—There is no other ventilation except by spouts that go up the houses, and wherever there is a drain near to a fall pipe we ventilate the sewer into that.

14,887. How do the sewers work when there is a heavy fall of rain, do they work properly?—Yes, they do.

14,888. No foul smells are driven up into the houses?—No; we have very few complaints about foul smells.

14,889. I take it that your thorough system of flushing tends to prevent any sediment, and diminishes the accumulation of foul air considerably?—Yes, it does.

14,890. Where is the sewage outlet?—Just below the town, at the junction with the Ellar beck and the other beck.

14,891. Have you considered the question as to the suitability of the land adjoining the outlet for irrigation purposes?—Yes, I have looked at it.

14,892. Have you taken any levels?—No; but they have been taken.

14,893. Was it found that the sewage could be applied to the land by gravitation?—Yes.

14,894. Do you find much sediment in any part of the river below the outlet of the sewer?—No; I have not seen much; what there was was all flushed away by the great flood.

14,895. If it was washed away by the recent flood it may be presumed to have been there before the flood came?—Yes, but I did not see it.

14,896. Have no complaints been made of its accumulating on the banks of the beck so as to become a nuisance?—No, not in our district.

14,897. Has your attention been called to the flooding of lands adjoining this beck and on the river Aire?—Yes.

14,898. Have you watched the improvements that have been made by the Airedale Improvement Company?—Yes, I have, lower down the river.

14,899. Do you find that, with the same fall of rain in the neighbourhood, the land is more or less flooded than it used to be?—I do not think that it is more flooded; I think that the water gets off more quickly.

14,900. Has that been an improvement to the adjoining land?—Yes, a great improvement.

14,901. How many years is it since these works were carried out here?—About two years ago.

14,902. You would hardly yet have seen much benefit from them?—There has been very great benefit up to the present time.

14,903. Would the lands have suffered much more by the late flood, if those works had not been carried out?—I have no doubt that they would.

14,904. Have you seen any of the means that have been resorted to for dealing with the debris that comes down the different becks?—No.

14,905. Have artificial banks been very generally raised down the valley between this town and Keighley, or are they of recent construction?—No, they are old embankments.

14,906. Can you say whether, within your recollection, the bed of the Aire has risen within those embankments?—No, I cannot speak to that.

14,907. How are the ashes and the contents of privies taken away from the town of Skipton?—They are taken away by a scavenger appointed by the board to the north and south of the town to places taken for the deposit of this refuse.

14,908. Is that carried out as a system throughout the town?—Yes.

14,909. At whose expense is it carried out?—At the expense of the parties.

14,910. Do you find that they are willing to bear that expense?—They are not very willing, the parties would rather take it away in the daytime, but the board will not allow that to be done.

14,911. Do you take precautions to disinfect these places after the scavenging has been done?—No.

SKIPTON.

Mr. W. Bradley.

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14,912. Do you use no chloride of lime?—Not that I know of.

14,913. What is the cost of conveying this refuse from Skipton in the course of a year?—I should say that if it was contracted for it would cost more than 150*l.* a year.

14,914. Does it cost more than that now?—The board pays for all the road scrapings and the leading away of the sewage and the cleaning out. The occupiers pay for cleaning out the ashpits themselves.

14,915. Do you take all the refuse from the roads into the country?—Yes, and put it on to the land, all of it.

14,916. (*Professor Way.*) In laying out your drainage system you must have known, I suppose, what quantity of water was likely to come through the sewers?—Yes.

14,917. Do you know any reason why the quantity of water should be so large as it has been described to us to be?—No.

14,918. Do you know the nature of the land below Skipton?—Part is clay land and part gravel.

14,919. There is a large extent of tolerably flat surface, is there not?—Yes.

14,920. Is there any large quantity of land in the hands of one landower?—Yes, there is in the hands of Sir Richard Tufton.

14,921. The estates below Skipton are largely possessed by him?—Yes.

14,922. Is he resident here?—No, but he has an agent here.

The witness withdrew.

Mr. J. Calvert.

Mr. JOHN CALVERT (Skipton) examined.

14,923. (*Chairman.*) I believe you are manager of the Skipton waterworks?—Yes.

14,924. In what year were they constructed?—In the year 1823.

14,925. Were you connected with their construction at all?—No, I was not.

14,926. By whom were they constructed?—By a private company.

14,927. Where are the waterworks situated?—In the valley below Rumble's Moor.

14,928. What distance are they from the town of Skipton?—About half a mile.

14,929. What is the extent of the gathering ground from which you draw your supply of water?—From 1,000 to 1,200 acres.

14,930. What is the area of your reservoir, or have you more than one?—We have three reservoirs.

14,931. What are their areas?—The three would hold about 7,000,000 gallons of water.

14,932. Of what height are the embankments?—Of one 9 feet, of another 17 feet, and of the third about 11 or 12 feet.

14,933. Have you provided means for passing off flood water at the side of those reservoirs?—Yes.

14,934. Had you any difficulty the other day during the heavy rains in passing off the overflow?—We had a little difficulty.

14,935. What steps were you then obliged to take?—The water came out on to the embankment and we planked it across and threw it down the bywash and it had a more rapid fall.

14,936. You put the planks on the top of the embankment?—Yes.

14,937. What is the level of the bywash?—The bottom of the bywash would be about four feet below the surface of the reservoirs.

14,938. What depth of water was then passing over the bywash?—It was full.

14,939. To which of the reservoirs do you now refer?—I should explain that one bywash answers for the whole of them, they are in a series on the same stream.

14,940. What is the length of your bywash?—About 250 yards.

14,941. What is the width of it?—About 4 feet 6 inches.

14,942. During the late heavy rain the water was passing over a width of 4 feet 6, and a depth of 4 feet?—Yes.

14,943. And the reservoir was level with the top of your embankment?—The reservoir overflowed the embankment.

14,944. Is it your intention to let the reservoirs remain as they are?—This was the first and only time that we have ever seen them overflow the embankment.

14,945. Shall you recommend steps to be taken to extend that bywash so as to prevent a repetition of that which might have been the cause of considerable mischief?—I have no doubt that the waterworks company would take some steps if they could see a necessity for it; they never object to do anything of that kind.

14,946. Do not you see a necessity for it?—Yes, I do, and I shall bring the matter before them when they are called together.

14,947. And urge it rather strongly, as you think it ought to be done?—Yes, it is very necessary.

14,948. (*Professor Way.*) Were you in any fear of the embankment at the time?—Not at all.

14,949. Does the washing of the water over the embankment tend to interfere with it?—The manner in which we succeeded in getting quit of the water entirely removed any apprehension. We got some planks and laid them on edge the length of the embankment, and that threw the water down into the channel of the bywash which was at a considerably lower incline than the part level with the reservoir; we did not feel disposed to cut the embankment.

14,950. Did you pass any water through the pipes from your reservoir?—I opened all the sluices and all the pipes that I could during the time when the water was so excessively violent.

14,951. In consequence of that there would have been flowing down the beck below, not only the flood water, but as much as you could pass out of your reservoirs?—Certainly.

14,952. There would have been more passing down the beck than would have been consequent upon that heavy fall of rain?—There would have been the quantity conveyed through a 6-inch pipe in addition to the overflow of water from the flood.

14,953. If the flood itself would have done damage, you by the necessity you were put to of opening the sluices, increased the volume and might so far have increased the damage done to property below the reservoir?—The quantity contained in the 6-inch pipe (which is the main pipe which supplies the town) would certainly have enlarged the flood, but not much. I thought it desirable to take all the means we possibly could to ease off the water from the reservoir.

14,954. You tried to lower the level of your reservoirs by opening all your sluices and letting the water run off, thereby adding to the volume which came down the beck?—Yes.

14,955. The water that you did let down so long as the reservoir was full would have come over the banks?—Yes.

14,956. So long as you did not lower the head you did not increase the quantity?—No.

14,957. (*Chairman.*) Was the result of this operation actually to lower the water in your reservoir?—I should state that the filter bed is below the reservoir, and I found that the water was accumulating so as to

be likely to pass over into the filter bed. Then I came to the town and opened the sluices, because from the filter bed the town is supplied, and whilst I was doing that I had a few men employed in putting planks across the embankment of the reservoir to throw the water down the by-wash.

14,958. What was the cost of your works?—About 7,000*l.*

14,959. What volume of water do you daily supply to the town?—About 100,000 gallons a day.

14,960. That is about 20 gallons per head of the population?—About that.

14,961. Is much of that 100,000 gallons used for manufacturing purposes?—None that I know of.

14,962. Is there a constant supply to the town?—Yes, except in very droughty times.

14,963. Do you find that with a constant supply the quantity consumed is about 20 gallons per head?—Yes, as near as may be.

14,964. Is yours a constant system?—Yes.

14,965. From what stratification do you obtain the water?—We get a portion of it from the Skibeden Valley, and the other we collect from Rumble's Moor Hills. The water comes down in a small stream from the mountains direct to the reservoirs.

14,966. Does the water come from millstone grit or limestone?—From millstone grit.

14,967. What is the quality of that water?—I cannot say, but it has been analysed.

14,968. Is it very soft water?—It is not excessively soft.

14,969. How many houses do you supply with water?—About 1,000.

14,970. How many houses are there in the town which are not supplied from your works?—I think there are not many.

14,971. 100,000 gallons distributed amongst 1,000 houses at the rate of 20 gallons per head would imply five persons to each house?—Yes.

14,972. At what rate do you supply the water?—It varies according to the rental of the houses from 5*l.* to 5*s.* a year.

14,973. Can you give in a list of the rates which you charge for the water?—No, I cannot at this moment.

14,974. You have no pumping?—No.

14,975. The water comes down by gravitation?—Yes, all by gravitation.

14,976. Then you pass it into each house?—Not into all. Some of them are supplied by stand-pipes, each of which supplies a certain number of houses.

14,977. Where are the stand-pipes placed, in the streets?—In the different localities, in courts and convenient places.

14,978. Do you supply water for cleaning the sewers?—Yes, we do.

14,979. Do you charge the board of health for that supply?—Yes.

14,980. At so much per annum?—Yes, at so much per annum for flushing each well.

14,981. Do you supply the railway company with water?—No.

14,982. What do you charge for each well to the board?—We charge 6*s.* 8*d.* for each well per half year.

14,983. What do you charge for supplying waterclosets with water?—The waterclosets vary. A cottage at a 5*l.* rental is charged 5*s.* a year for water rate, and if there is a closet attached to it we charge 2*s.* 4*d.* more, making together 7*s.* 4*d.* If we supply water to a 9*l.* or 10*l.* house the charge is about 8*s.* or 9*s.*, as the case may be, but it varies. Sometimes it is 1*s.* 6*d.* per quarter, this 6*s.* a year with a watercloset added.

14,984. For a 15*l.* house how much do you charge?—About 15*s.* a year for the water, and for the watercloset about 7*s.* 6*d.* a year. In a 20*l.* house we should charge 10*s.* a year for the closet and 1*l.* a year for the water for domestic purposes.

14,985. Above that rental what charge do you make?—We have not many houses above that rental.

14,986. Have you water rates for baths?—Yes, we charge 5*s.* a year for each bath.

14,987. Are there any public baths?—No.

14,988. Do the improvement commissioners take water from you for watering the streets?—No.

14,989. (*Professor Way.*) You say that you supply 100,000 gallons per day?—Yes.

14,990. That is for domestic use, and you supply a further quantity for flushing the sewers?—Yes.

14,991. Can you give us any notion how much that is?—No, I could not at the moment.

14,992. Do you think it is 20,000 gallons a year?—I should think it would not be far off that volume.

14,993. It would not double the quantity of water that you supply for other purposes?—No.

14,994. Do you think it is 50,000 gallons?—No.

14,995. You probably heard Mr. Sidgwick speak of the difficulty there would be in applying the sewage on account of the large bulk of water with which it was diluted?—I did not hear his evidence.

14,996. Do you know what the general supply to other towns is, or is it usual to supply 20 gallons of water per head?—I have heard of some towns being supplied with less and some with more. Some towns, I presume, are supplied with as much as 30 gallons per head.

14,997. Have you heard what quantity of water is supplied to Croydon?—Yes.

14,998. Do you know that Croydon is supplied with 1,000,000 gallons for a population something above 30,000, which would be over 30 gallons per head?—I daresay it is so.

14,999. I suppose that in very many districts where there is a porous soil the quantity of water which gets into the sewers from rain and from the surface is very much greater than the water supplied?—I daresay it is.

15,000. Would you be surprised to hear that at Croydon the quantity of water which actually passes out of the main sewer is from two and a half to three times as much as the water which is supplied to the town?—No.

15,001. If the whole of that could be applied to the land with benefit, do you see any reason why you should not apply the whole of your 20 or 25 gallons per head?—Certainly not.

15,002. The volume with which you would have to deal is not after all an excessive quantity?—No, it is not, but we could not exactly maintain that quantity in a very droughty summer, such as we have had the two last summers.

15,003. I suppose you would have plenty of water to dilute the sewage with if you wanted to do so at any time?—No.

15,004. When your watercloset system is fully carried out I suppose you could do with the same quantity of water as other people do under like circumstances, that is to say, for the supply of 5,000 people, you must make 20 gallons per head suffice?—Yes, if that would be sufficient. My opinion is that if the watercloset system was carried out the amount of water that could be collected from the sources that we have, if properly stored, would give more than 30 gallons per head.

15,005. You might get more if you wanted it, but you are not obliged to pass through your sewers more than is necessary, and you are not likely, I suppose, to be obliged to do so?—No.

15,006. Have you paid attention to the question of applying sewage to the land?—No, I have not, except that I have read a little about it.

15,007. (*Chairman.*) Are there any mills situated on the beck below your reservoirs?—None.

15,008. You have no compensation to give?—No.

The witness withdrew.

SKIPTON.

Mr. W. Marsden.

9 Nov. 1866.

Mr. William Marsden (Skipton) examined.

15,009. (*Chairman.*) I believe you are a surgeon in this district?—I am.

15,010. And a member of the College of Surgeons?—Yes.

15,011. Have you practised for many years in the neighbourhood of Skipton?—About 48 years.

15,012. Then you are well acquainted with the state of health of the people in the neighbourhood?—I am.

15,013. Has it improved since you first knew the neighbourhood of Skipton?—Very much.

15,014. Has the population of Skipton itself increased within your recollection to any great extent?—It has.

15,015. What was it when you first knew it?—I cannot tell exactly.

15,016. Do you suppose that it has doubled within the 48 years?—No, I should think that it is about one-third more.

15,017. To what do you attribute the improvement in the health of the people of Skipton and the neighbourhood?—To the general cleanliness which has been maintained, not only by the medical men, but by the town itself; the town is very much cleaner than it used to be.

15,018. From what period has that improvement been marked?—I should say that it has been observable in the last 24 or 25 years. It has arisen from the establishment of the gas company, and also from paving and keeping the streets cleaner than they used to be.

15,019. Then the improvement was in operation before the formation of the local board of health?—Yes, the local board of health is quite young.

15,920. Who were the movers in the improvement previous to the formation of the local board, that is to say, the improvement in the condition of the town which led to the improvement in the health of the people?—I should say the inhabitants generally. There was a general stir not only by the medical men but by the officers of the town.

15,021. What is the character of the diseases which you find to be less frequent now than they were 35 years ago?—Fever in general; common fever, typhus fever.

15,022. Has the improvement been more marked since the local board have taken steps to improve the condition of the cottages?—That is only of very recent date, it has only just come into force.

15,023. Can you feel it?—I am sure that there has been less disease in the town of late years; less fever disease.

15,024. As well as fewer deaths?—I know that the deaths have increased on account of the number of inhabitants.

15,025. But I mean fewer deaths in proportion?—About 25 years ago there was a season when double the number of interments took place in one year than had ever been known before.

15,026. But there is a marked improvement in the general health of the people?—Yes.

15,027. And that is a very important element?—Yes; the cause is that we have had a more plentiful and better supply of water, and the streets have been kept cleaner, and the roads have been kept cleaner and in better condition.

15,028. And the people are more comfortable?—I should say so.

15,029. In your experience have you found that this improved condition of the people has led to the diminution of drunkenness among the people?—I cannot say that. Skipton is not to be called a drunken town, but we have about 35 or 36 inns in the town, and they must be made use of by some people.

15,030. Is that supply consequent upon the demand within the town?—No, it is on account of the fairs in the locality.

15,031. Are there many fairs held in the town of Skipton?—Yes, when cattle fairs are permissible; at present they are shut up.

15,032. Is Skipton the centre of a considerable agricultural district?—There is an immense district round about.

15,033. And the cattle are brought here for sale?—Yes, from 20 miles round.

15,034. How many fairs are there in the course of the year?—There are fortnightly fairs besides annual fairs.

15,035. Do you think that the fact of those fairs being so frequent, and of the number of publichouses which there are in the town to meet the requirements of the people coming to the town, has been injurious to the moral condition of the people?—No, the injury is only for one day.

15,036. Do you think that it does not leave its mark after that day has passed?—I think not. Of course that day is a day when everybody must have refreshment in one shape or another.

15,037. Do you know the district below Skipton through which the river Aire passes?—Yes.

15,038. We had it stated to us just now, that in consequence of the works which have been carried out, floods are less frequent now than they were formerly?—They are much less frequent.

15,039. It was stated yesterday, at Keighley, that in the neighbourhood of Skipton, when these floods were so frequent and excessive, fever used to be also very frequent; was that your experience?—Yes.

15,040. Have you observed any diminution in that fever?—I have.

15,041. There is less fever now?—Yes.

15,042. Do you attribute that to the carrying out of these works?—Yes; and the improvement of the health of the people by the drainage of all the villages and towns about.

15,043. How long have these works for the improvement of the river been executed?—Five or six years, not more than that.

15,044. But within that period the improvement in the health of the people has been so marked that you can state it as a fact?—I can.

15,045. Have you ague in the valley?—I may almost say never; I have not seen more than two or three cases of ague in the whole course of my practice.

15,046. Had you formerly much fever in Skipton itself?—Yes, and in Carlton, which is on the borders of the river. We are a mile from the river, and there is a good fall to the river.

15,047. What was the character of that fever?—Typhoid.

15,048. Is it as frequent now as it used to be?—No; it is now very infrequent, whereas formerly there were 70 or 80 cases in one winter. This was the largest number I ever had. It was in 1835.

15,049. Have improvements been made in the village of Carlton as well as in Skipton?—Yes, great improvements.

15,050. And do you attribute to those improvements the absence of fever?—I should say so, or rather to general improvement of the village itself.

15,051. (*Professor Way.*) Has there been much land drainage in this neighbourhood?—There has always been drainage going on.

15,052. Does the draining of a district improve its health?—Of course it does.

15,053. (*Chairman.*) On what beck is the village of Carlton situated?—It is south-west of the river.

15,054. Is it situated on a beck?—There is a small beck which comes down, but of no great moment.

15,055. Are there lead mines situated on that beck?—No, there are lead mines below, but not there.

15,056. What is the name of the beck on which the lead mines are situated?—It has not any particular name; the lead mines are three miles from Skipton.

15,057. Are those lead mines the property of the Duke of Devonshire?—They are; they are situated down on the south road to Keighley.

15,058. Do you know anything of that district?—Yes, I know it very well.

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15,059. Is there any refuse sent from those lead mines which is at all injurious to the water?—Not that I know of. The village is now supplied with good water.

15,060. Is the water used by the people residing on the banks?—Yes, they used to use that lead water.

15,061. You would not recommend that lead water for domestic use?—Certainly not.

15,062. (*Professor Way.*) The river after receiving the water from the lead mines does not come to you, does it?—No the lead mines are three miles south.

15,063. (*Chairman.*) In your experience, do you attribute any of the sickness to the presence of ashpits close to the houses?—All ashpits are nuisances, and are likely to create disease, but we have not many ashpits here.

15,064. Are you an advocate for their being converted into waterclosets?—I never thought much upon the subject. I know that the privies used to be very bad on account of the great number of people who had to go to them. We have not had time to give an opinion upon the waterclosets; they have only come into use in the last two years.

The witness withdrew.

Mr. Benson Bailey (Skipton) examined. *Mr. B. Bailey.*

15,065. (*Chairman.*) How many years have you resided at Skipton?—40.

15,066. Are you the Registrar of Births and Deaths for the neighbourhood?—Yes.

15,067. What is the extent of the district for which you keep the register? How many townships does it include?—Eight.

15,068. Can you give us the death rate in those several townships at present?—It is about 26 per 1,000.

15,069. Will you give it to us in each separate township if you can do so?—I cannot do that; I have made my calculation upon the township of Skipton, and not for each township, but I believe that the average will be almost the same, viz., 26 throughout the district.

15,070. Can you give us the population of each township?—I cannot at present.

15,071. Are the townships, other than Skipton, more of the character of villages and detached houses?—Yes.

15,072. Do you think that the death rate is as high there as it is in the town of Skipton?—Perhaps not quite, but there will not be very much difference.

15,073. Is it as high as 26 in 1,000 out in the country?—I think so, as nearly as I can calculate it.

15,074. Can you tell us what it has been for some years past?—There has not been very much variation, except in cases where there has been an epidemic.

15,075. Can you give it to us for a few years?—I daresay that I could with a little calculation; I have observed the matter for several years, and I have made the result about that. I believe that 26 per 1,000 annually is nearly correct as the number of deaths.

15,076. Did you hear the evidence of the last witness, Mr. Marsden?—I was present.

15,077. Did you hear him state that his experience was that the health of the people in this neighbourhood was very much improved of late years?—I think that I did hear him say so.

15,078. Is not that rather inconsistent with the return which you give us of the death rate?—The death rate seems rather high.

15,079. And from your account it seems to have been high for years past?—Yes.

15,080. Will you be kind enough to give us the death rate and the population of your district for as many years back as you can; that is to say, between 1851 and 1861, and up to the present time?—I will do so.

15,081. (*Professor Way.*) In the outlying districts is there much consumption?—The most prevalent diseases are bronchitis and phthisis or consumption.

15,082. And that, I suppose, has increased of late in the outlying districts, the exposed districts on the hill sides for instance?—From those districts there is very generally bronchitis.

15,083. And I suppose that an unusual death rate in an agricultural area may be occasioned by the fact of its comprising exposed and elevated districts where consumption occurs to a great extent?—I do not know that consumption prevails more in elevated districts, than it does in other places. I think that it is about as prevalent in the town as in the country, and in the country as in the town.

15,084. The question is whether your district is more liable to consumption than a more southerly district, that you do not know?—That I do not know of course.

15,085. (*Chairman.*) How many years have you been registrar?—About 21.

15,086. Is the district of which you keep the register the same now as it was 20 years ago?—Yes.

15,087. Can you give us the number of inhabitants within that district, and the deaths per annum then, and the number of inhabitants and the deaths per annum now?—I cannot do so at present.

15,088. Could you make out that return without much difficulty?—I could make it out from 1851 to 1861.

15,089. And on to the present time. If you will be kind enough to do so we shall be obliged to you?—I will do so.

The witness withdrew.

(*Mr. Dewhurst.*) There is a workhouse in Skipton with 100 inmates, which is the workhouse for nearly fifty townships, and which contains a number of aged people, the whole of the mortality of that workhouse comes into this township returns, and that increases our death rate.

(*Professor Way.*) That is an important mortality?

(*Mr. Dewhurst.*) Yes.

Mr. Leonard Horner (Skipton) examined. *Mr. L. Horner.*

15,090. (*Chairman.*) Do you live at Skipton?—Yes.

15,091. Are you engaged in any manufacture?—In the lead manufacture, sheet lead and pipes.

15,092. From pigs of lead?—Yes.

15,093. You obtain pigs of lead from the manufacturers and convert them into pipes and sheets?—We manufacture pigs of lead into sheets and pipes.

15,094. Is there any refuse from your works?—There are ashes.

15,095. What do you do with them?—We have them carried away by the boat on the Leeds and Liverpool canal.

15,096. You do not turn any of your ashes into the river?—No.

15,097. How many hands do you employ?—Ten.

15,098. Have you steam-power?—Yes.

15,099. Of about what amount?—16 horse.

15,100. What becomes of the excrement from the men about your premises?—That is taken away about every three months and is put on to the land.

15,101. None of it goes into the river?—None of it, we are not situated on the river, we are situated on the Leeds and Liverpool canal.

15,102. What quantity of lead do you manufacture in the course of the year?—On an average about 2,500 tons.

15,103. Where do you obtain it?—From the Duke of Devonshire's mines at Grassington and Conouley,

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and a great quantity out of the north, from Richmond and from Llanelly in South Wales.

15,104. Do you know what weight of lead is obtained from the Grassington Valley?—At present the mines are very poor, in the neighbouring mines about 400 tons a year are produced, and at Cononley 200.

15,105. Do they wash the ore there?—Yes.

15,106. Do you visit the works?—No, I have not been there since I was a child. I cannot give you much information with respect to the washings at Grassington.

15,107. Do you know lead mines generally; have you visited them in other parts?—No.

15,108. (*Professor Way.*) You do not smelt at all?—No, we are not smelters, but merely manufacturers.

15,109. Have you to melt the lead?—The lead is melted.

15,110. You have I suppose to cast it in certain plates before rolling it?—Yes.

15,111. Is much dross produced?—About 4 tons of lead ore will produce about ½ cwt. of lead, and we smelt the ashes about every nine months.

15,112. So as to get out of them any lead which has escaped?—Yes.

15,113. Do you smelt the dross at the same time?—We preserve it until we get a sufficient quantity and then the smelter comes over and smelts the ashes for us.

15,114. What I call the dross is what you call the ashes?—Yes.

15,115. Is the silver taken out of your lead?—No; the duke's lead I suppose will not pay for extracting the silver, it is too poor.

15,116. They do not attempt to extract the silver at the works do they?—No, the lead is too poor, the process would not pay.

15,117. Is the health of your men good?—It is generally good, we have men that have been from 20 to 30 years on the premises.

15,118. You do not, I suppose, use water in any part of your operation?—No.

15,119. Are the men never affected through the skin by working the lead, have they not gripings, or lead cholic?—No, I have not known a case of the kind. We have ventilators over each pan, to carry off the fumes.

The witness withdrew.

The witness subsequently added to his evidence the following note: The watercourses should be provided with filters to keep out the quantity of gravel arising from the washings; and should be kept clear of dead dogs, etc., which being left in, in a dry season are an intolerable nuisance.

Mr. B. H. Bradley.

Mr. Benjamin Hutton Bradley (Skipton) examined.

15,120. (*Chairman.*) How far do you live from Skipton?—About a mile to the south.

15,121. You are vice-chairman of the Skipton Board of Guardians?—I am.

15,122. How many parishes are there in your union?—About 51.

15,123. What is the area?—About 150,000 acres.

15,124. What is the population?—About 37,000. I did not come here prepared to give any evidence, I was merely present as a listener.

15,125. As vice-chairman of the Board of Guardians have you observed the working of the Nuisances Removal Act?—We have had very little to do with it.

15,126. Have you not had to to with it for some years?—Some years ago when it became the law the guardians were concerned with it.

15,127. Did you then take any steps to remove nuisances in the union?—I was not in connexion with the board at that time.

15,128. The matter of nuisances is not now so immediately placed under the control of the board of guardians?—It is not.

15,129. How many years have you been a guardian?—I have been vice-chairman for six years. I was a guardian two years previously, making about eight years altogether.

15,130. Skipton is within the Skipton Union?—Yes.

15,131. Do you find that the health of the poor in Skipton has at all improved during your guardianship?—It has decidedly improved, the people are better kept, and better attended to than they were. There is in fact no destitution in the neighbourhood; they are all well employed, and are as comfortable as you would expect them to be in their position.

15,132. Considering the population of your union, 100 strikes me as being a small number to have in the workhouse?—It is a very small number.

15,133. Are they chiefly infirm persons or children?—We have scarcely an ablebodied person at present in the workhouse.

15,134. I believe that as well as being vice-chairman to the Board of Guardians you are one of the Airedale Improvement Commissioners?—I am.

15,135. Have you been so since the commencement?—Yes.

15,136. How many years ago was that?—The Act was got in 1861, but not much work was done till 1862.

15,137. Have the works in this neighbourhood been carried out for some years?—Yes, they have been completed in this neighbourhood for about three years.

15,138. Have you derived the beneficial effects which you expected from the execution of those works?—The health of the district is very much improved by them, and the land is improved to a considerable extent.

15,139. What evidence have you with respect to the improvement in the health of the people?—The villages were subject to fever from time to time, and it lingered about them for a long time, and there was a great loss of life. Within the last three years I do not know a case of any village suffering very much from fever. We had one case of typhus fever in our village at Bradley but it died away, and did not spread at all in the village. Previously, when a case of typhus fever broke out, it went through the village and would linger a long time about it.

15,140. As a member of the Board of Guardians of the poor you would have experience upon that point?—It is in that position that I see more of it than I otherwise should do. It is rather unfortunate that you have not the registrar from the Crosshills district here, they suffered very much from fever there. I think that he would have been able to show that the health of the district has very much improved since the drainage has been carried out.

15,141. It is highly desirable that we should have that information if you can get it for us?—I will speak to the registrar upon the point.

15,142. (*Professor Way.*) Has there been lately any diminution in the poor rate?—There has been a re-assessment, and since the alteration of the law many townships which before paid scarcely any poor rate now pay the full rate, and of course other townships are relieved to the same extent.

15,143. But have you any means of knowing the rate in the pound?—The total will be abont one-third less.

15,144. Then taking the whole district the rate has positively diminished?—Yes, the rate for the whole union will be about one-third less than it was, but what the result is to any particular township must depend much upon the effect of the alteration in the law.

15,145. But your experience would point out to you that a diminution in the causes of disease, and therefore in disease, and in the attendant deaths as well as discomforts, would alter the amount of the poor rate?—Yes; disease has a serious effect upon rates. We have frequently had families who have

been costing us 14*s.* or 15*s.* a week, of course that is for out-door relief, they could not be brought into the house in case of fever.

15,146. Therefore the reduction of the poor rate and the reduction of the death rate ought to have some relation to each other?—They should.

15,147. (*Chairman.*) You heard the registrar mention that in the district for which he acts the death rate is about 26 per 1000?—Yes.

15,148. That as you probably know is a high death rate for a country district as this is to a great extent, how can you account for it?—I do not know that that is the case, I am not prepared to say whether the rate is 26 in 1,000 or not.

15,149. (*Professor Way.*) Are not the forms returned to the registrar general?—They are, perhaps you would like to see the returns for the union. The registrar for Skipton, whom you examined, would have no knowledge of the whole union.

15,150. Do you think that the death rate for Skipton is 26 in 1,000?

(*Mr. Dewhurst.*) A few years ago it was above 30 in my recollection within the district of the Skipton Local Board of Health.

(*Mr. Bradley.*) I suppose that in the workhouse in Skipton the deaths will average fully one in a fortnight, and those are frequently cases which are brought in from a distance. Very often aged people are removed.

15,151. That would especially affect the death rate in Skipton?—It does so. It has been the custom for years past for families to leave this union to work in Bradford and Bingley and the districts below, and very often when they become infirm they are removable to our workhouse, and in that case of course we have a very old population thrown into our workhouse.

15,152. Is it not the case that one death in a fortnight, that is to say 26 deaths in a year, occurring in the union workhouse would account for five or six out of the 26 per 1,000?—It has a very material effect upon the death-rate for Skipton.

15,153. The population is 5,000. One death in a fortnight is exactly 26 in a year, and the death rate of the whole 5,000 is 26 per 1,000, and therefore the deaths in the workhouse are five or six out of the 26, which reduces the death rate proper to 20?—Yes; the mortality in the workhouse must have a very considerable effect upon the death rate in Skipton.

15,154. (*Chairman.*) Do you occupy any land in the valley of the Aire?—I do.

15,155. To what extent?—About 130 acres.

15,156. Is any of it land which has been improved by the Airedale commissioners?—Yes.

15,157. To what extent?—About 40 acres.

15,158. Did you occupy that land before the improvements were made?—I did.

15,159. And as the tenant of that land do you experience improvement from the works which have been executed?—As to the lower part of it, decidedly.

15,160. Is it pasture land?—Yes. The floods are less frequent than they were, and the water gets away more rapidly. Formerly if we had a considerable fresh the river would frequently be from 24 to 48 hours in getting down, and now it gets down in two or three hours, excepting in the case of an extraordinary flood, such as we have had lately.

15,161. Have you made internal drainage as well as improvement in the river itself so as to carry the water off from that land to a lower level?—Yes; the land was drained before the commissioners improved the river, but since the improvement of course our drains have had a better effect. You were speaking about impediments in the river and about the river silting up. We find by experience that in almost all places where the Aire has silted up currents or becks run into the river.

15,162. Nearly at right angles?—Nearly at right angles, or in any case where a considerable amount of wreck is brought into the river, and it is there that impediment generally takes place.

15,163. A deposit is formed at the mouth of the beck, and that creates an obstruction to the river Aire itself?—Yes; in almost every case the impediment has been caused by a brook in that way.

15,164. As commissioners you have executed some works to prevent this *débris* being carried into the river Aire, have you not?—Yes.

15,165. A kind of trap?—Yes.

15,166. What do you call them?—We call them gravel-traps.

15,167. Have those gravel-traps been successful?—Yes. Where the Glusburn beck enters the Aire there are three traps in succession, one above another. They are filling up now and want cleaning out. At Cononley Beck there has been no ground trap made, and the refuse brought into the river there is particularly heavy, because the beck comes from the Duke of Devonshire's lead mines. The deposit from that beck when it gets into the bed of the river remains there. It does not drift down in the same way as the loose gravel.

15,168. After the heavy flood the other day has much deposit collected at the mouth of that beck?—I have not been down since the water subsided.

15,169. If a considerable collection of gravel accumulated at the mouth of that beck the improvements which you have made might be almost negatived by this formation during a heavy flood?—Yes. They are about to make a gravel-trap there, but I think that the work is not yet contracted for. It is ordered to be done.

15,170. What do you consider to be the increase caused by the improvements in the annual value of the land which you occupy and which was subject to flooding?—The drainage will not be a success in a monetary point of view.

15,171. How do you account for that?—The works have cost more than they were expected to do, and the area to be benefited is much less than was anticipated.

15,172. But the health of the district is very decidedly improved?—Decidedly.

15,173. Do you know the district below Keighley?—Not very well. I have of course seen it, but I do not know much about it.

15,174. Are you aware that Mr. Ferrand and others think that you benefit yourselves at their expense?—I saw his statement, but I did not believe it.

15,174*a*. You admit that the water goes away from your district more readily than it used to do?—The old course of the Eller beck was from Skipton valley to the CarltonWood Bridge; a new cutting was made from near Skipton to a point below Carlton Stone Bridge, so that the water now discharges itself about a mile lower down the river than formerly, and in an ordinary fresh will be out of the district before the flood from the upper part of this valley joins.

15,175. So that you anticipate the flood, and discharge some of the water at a period previous to that at which it used to be discharged, and the result is that there does not come down so much in bulk as there did formerly?—The land which I occupy down the river is below the junction of the new cutting, and of course if any lands would be more subject to flood than others it would be just those where the river and the beck brought together. My first impression was that when that cutting was made we were doing away with the large reservoir above and should be more subject to flood, but in practice we find that the water comes down so much more readily that it gets away before the upper water reaches us, so much so that instead of having frequent floods we have only had two general floods since the river was altered. One was on the occasion of an excessive thunderstorm in the Aire after the river was diverted, and the other has been the present flood. Of course nothing could have saved us from either flood.

15,176. Has the present flood continued as long upon the land as a similar flood would formerly have done?—No; the valley below would have been a swamp for a long time to come under the old state of things.

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15,177. The water from it gradually passing off?—Yes.

15,178. Are you aware that the view which those below take of this district is that it is a kind of reservoir for them, and that the water formerly went down gradually and gave them power in a much more steady manner than it does now?—I had the same impression until I saw the new arrangement worked. I thought that the reservoir was being taken away, and that we should have flooding to a greater extent below, but that does not appear to be the case in practice.

15,179. (*Professor Way.*) I suppose that if any persons below are aggrieved it is open to them in like manner to arrange to pass the water on to somebody else?—Yes.

15,180. And improvement must not be retarded because some persons are behind others?—No. I think you asked Mr. Marsden some questions with regard to ague. About the year 1798 there were some works carried out in the Bradley Ings. Previously to that time I have heard people say that the inhabitants were very subject to ague in the valley, but it ceased to exist after those works were made.

15,181. (*Chairman.*) Those works expedited the clearing off of the water?—Yes; and now with the extra works you have a considerable diminution of fever. In fact there is scarcely any fever but typhus fever, which sometimes exists.

15,182. The first works removed the ague, and the second works removed fever?—Yes, so far as I can judge.

15,183. Where these banks exist on each side of the river Aire have you found the bed of the river rise in your recollection?—No. The rising of the bed of the river has been simply from deposit in the bed, so far as my observation goes.

15,184. (*Professor Way.*) Are you aware that ague has been disappearing from this country altogether in the last few years?—I merely speak of this locality.

15,185. Do you know that in the districts in which it formerly lurked it is not to be found now. There is a place at the mouth of the river Thames called Foulness where nothing has been done in the way of drainage, it was exceedingly subject to ague, but is not so now?—I cannot speak upon that point.

15,186. (*Chairman.*) Is the land which you occupy conveniently situated for taking the sewage of Skipton upon it?—No.

15,187. If you had land so situated should you be willing to take the sewage upon it?—Yes. I should be very glad to have an opportunity of doing so.

15,188. Do you think that you could apply it with advantage and without expense to the town?—Of course, if it was brought to me I could apply it with considerable advantage without expense to anybody.

15,189. Then you think that the whole expense which they would be at to apply their sewage would be in extending their sewer to the point of discharge?—I should think so.

15,190. And that then a farmer would be very willing to take the sewage and apply it to his land?—I should think so. I should for one; but I see here the agent of Sir Richard Tufton, who is the owner of nearly the whole of the land to which it could be applied.

15,191. Is there anything else to which you would wish to draw our attention?—I do not know whether you have exactly a correct impression about the new cutting in the Eller beck below the town, that is, before the Eller beck gets to the Aire.

15,192. Does that come within the district of the Airedale Improvement Commissioners?—Yes.

15,193. That was I think mentioned by Mr. Sidgwick?—Yes, I think that he named it. During the summers of 1864 and 1865 and the early part of 1866, which was dry, the mills above were able to hold back nearly the whole of the water of the beck, and then that cutting was left dry during the evenings, and the stench from it was very bad indeed.

15,194. The sewage was discharged into the bed of an empty stream?—Yes.

15,195. That would be an argument in favour of applying it to land?—Decidedly.

15,196. And, as a farmer, does it not rather grieve you than otherwise to see all that sewage going away and not being applied usefully?—I would much rather see it utilized. I do not know whether what I am about to mention is within your province, but the board of health in order to get rid of the refuse from their privies have made a receptacle about a quarter of a mile out of the town; the place chosen is as public a place as they could have it, it is almost where the Carlton Road leaves the Keighley Road. The soil is led there, and is deposited and remains there for weeks.

15,197. Is the place near any dwellings?—There are two very good houses, new buildings, which are unfortunately placed between that spot and the Eller beck cutting.

15,198. Have the persons residing in those houses applied to you as guardians for the removal of the nuisance?—No; they are within the jurisdiction of our improvement board and being members of the board of health they have the remedy in their own hands if they like.

15,199. If they signed a paper and sent it to you as guardians, you could inspect and order the removal?—No, we could not.

15,200. The remedy exists?—It exists, but it rests with the board of health.

15,201. (*Professor Way.*) After all, I suppose this is merely a transitory evil; it arises from the cleansing out of these privies, and the privies are in course of being abolished?—Yes.

15,202. But still you think that the cleansing might be done in a better way?—To lead the soil so near the town and to let it remain there is a nuisance.

15,203. Could it be disposed of directly for agricultural purposes?—There would be more cost to some one. They deposit it in the nearest place, and it remains there until it is required, and then it is fetched away.

15,204. And it remains there to its own injury, I suppose?—Of course, it wastes very much.

The witness withdrew.

Mr. A. Nicolson, C.E.

Mr. Angus Nicolson, C.E. (Skipton), examined.

15,205. (*Chairman.*) Are you a resident at Skipton?—I am.

15,206. I believe you are agent to Sir Richard Tufton?—I am his local agent.

15,207. You have charge of his land in the neighbourhood of Skipton?—Yes.

15,208. What extent of property does Sir Richard Tufton possess in this neighbourhood?—Land worth about 15,000*l.* a year.

15,209. Does much of the town of Skipton belong to him?—From one-fourth to one-third of the town.

15,210. Is the condition of the houses in that part of the town good?—Yes, it is very fair.

15,211. You are interested in any improvements which are recommended by the local board of health, and you see to them and have them executed?—Yes, they are carried out at once.

15,212. And in general are they, in your opinion, well carried out?—Yes, but I do not think that the system of sewerage has been well carried out.

15,213. What do you think is objectionable in it?—The design was very good, but it has been carried out imperfectly; in the first place, they used very inferior material in constructing the sewers; in fact, they have been constructed of the refuse of brick yards, and in forming the main sewers through the streets they plugged off all the old drains and did not form new drains till a long time afterwards, and some of them I have no doubt are unformed yet.

15,214. What is the stratification through which the sewer passed?—In some places clay, but to a great extent gravel.

15,215. And the refuse found its way into that gravel instead of into the sewer?—Yes, and came back into the houses.

15,216. Have you found cases where such an objectionable result has occurred?—Yes, some of them occurred to houses under my charge.

15,217. Was there illness consequent upon it?—Yes.

15,218. Cases which you know?—Yes.

15,219. Does the evil exist at present, or has it been remedied?—It has been corrected wherever we have found it to exist.

15,220. In what other way do you think that the system of sewerage has not been well carried out?—Many of the side drains which have been executed are stopped up, and are subject to stopping up; they do not act well.

15,221. There is not a sufficient fall?—I suppose so; they are not built with a regular gradient.

15,222. Do you think that to any great extent there is an accumulation of dirt between the houses and the sewers?—We have found it in some cases.

15,223. (*Professor Way.*) Are pipes used for the sewers?—Yes, in all side drains.

15,224. (*Chairman.*) And they are not well laid?—They are not.

15,225. Are those side pipes laid under the direction of the board of health?—Yes.

15,226. But the work has been inefficiently executed?—Yes, in many cases.

15,227. We have heard that the main sewers themselves are well flushed out; have you found that to be the case?—Yes; I believe that they are; we have an abundance of water.

15,228. Is the mischief of which you complain in the house connexions?—Yes; in the house drains.

15,229. Do you know the outlet of the main sewer?—Yes.

15,230. Does it discharge near Sir Richard Tufton's land?—On his land.

15,231. Is there land below that outlet which would be suitable for sewage irrigation?—Not immediately below, but the sewage could be carried by gravitation to land further down at some cost.

15,232. What length must the sewer be extended so as to reach that land?—200 or 300 yards.

15,233. 200 or 300 yards would take it upon the surface?—Yes, but deep cutting would be required.

15,234. What depth of cutting?—The sewage might be taken in two or three directions; but the plan where it could be used with the best effect would be lower down the valley southward; there is rising ground there so that I should think that a cutting of 15 feet would be requisite.

15,235. (*Professor Way.*) Could not the sewer follow the course of the stream?—The stream as diverted is in a cutting of 12 feet deep.

15,236. Supposing that pipes were laid near the bed of the stream, would there then be any necessity for deep cuttings?—Yes, because the stream is on a rising ground; in fact, there is a cutting formed for the stream.

15,237. Could not the pipe go in the stream itself without objection?—No; I do not think that that could be done.

15,238. (*Chairman.*) What do you think would be the cost of extending the sewer?—I am scarcely prepared to say that just now; the cutting is not bad.

15,239. Does the land which you say would be suitable belong to Sir Richard Tufton?—Yes.

15,240. Would Sir Richard Tufton be willing to have the sewage distributed over that land?—It depends upon the quality of the sewage matter; there is much water here; the rainfall is so great and so much water is used for domestic purposes, and so little sewage matter goes into the sewer, that I am doubtful whether the contents of the sewers would have a good effect upon the land; it is a subject for consideration.

15,241. (*Professor Way.*) I suppose that one reason why the system of waterclosts does not get developed to its utmost, is that it results in the fouling of the stream?—I think that there is another reason, namely, that we are generally short of water here in summer.

15,242. We understood from the manager of the water works that he could readily supply from 20 to 30 gallons per head all the year round?—Not in summer; we have been for months in summer almost without any water, with only a very short supply.

15,243. Supposing the sewage of this town to be carried on to the land, is it not probable that the water-closet system would be extended, so that you would get a stronger and more useful liquid for agricultural purposes?—Yes, if you had sufficient water.

15,244. One hangs upon the other to a great extent?—Yes; waterclosets become an injury if there is no water for them in summer; they become offensive, and instead of improving the health of the house, they are an injury.

15,245. (*Chairman.*) Your objection is that in summer there is not water sufficient to cleanse the waterclosets properly or to throw the matter on to the land, even if there was the land which would take it?—Exactly so.

15,246. And therefore you object to going to any expense to carry out sewage irrigation?—I am not sure that Sir Richard Tufton would go to expense in any case; it depends very much upon the analysis of the contents of the sewers.

15,247. (*Professor Way.*) In estimating the strength of the sewage, should you not look forward to the time when the water supply will be sufficient for watercloset purposes in summer as well as in winter, instead of adopting as a standard the present state of the water supply?—Precisely; sewage matter might be applied with advantage to land where the subsoil is porous, so that a large quantity of water laid upon the soil would pass off quickly, but land where the subsoil is clay would require a very expensive system of drainage before sewage could be applied with advantage.

15,248. (*Chairman.*) At Norwood, sewage is carried on upon stiff land with very great success?—We have a very wet climate here, and our land as a rule is saturated with water.

15,249. What is the rainfall in this district?—I should say about 45 inches.

15,250. Is that the average or does it vary?—I have never gauged it.

(*Mr. Heelis.*) Last year it was 32 inches, but that was an exceptional year; we were nearly burnt up. I believe that the average is about 36 inches.

15,251. (*Professor Way.*) (To Mr. Nicolson.) Would the rainfall be greater here than at Keighley?—I should say so; we are here surrounded by very considerable moors. The experiment could be very easily applied here; perhaps on an extent of land of 20 to 30 acres it could be tried at a very trifling cost.

15,252. Twenty-five acres would take the whole of your sewage?—We could obtain 25 acres for such an experiment, on which it could be tried without any cost for any cutting. I quite think that the experiment is worth trying.

15,253. (*Chairman.*) Have you ever considered the question of the management under which the river should be placed; or if the government deemed it requisite that rivers should not be polluted, have you considered what preventive measures might be successfully carried out?—I think that there should be some separate staff for the conservancy of the rivers, apart from local bodies altogether.

15,254. You would not leave it to Skipton to keep the sewage of Skipton out of the river?—By no means.

15,255. Under whom would you place the staff which you suggest?—If there was a national scheme for the purpose, I should think that there would be some central authority for regulating all the minor machinery throughout the country; but if the work was only done on a small scale, for instance, for Skipton alone, the matter might be left with advantage to the local authorities, to the board of health.

15,256. (*Professor Way.*) Taking the two districts

SKIPTON.

Mr. A. Nicolson, C.E.

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of the Aire and Calder, supposing that any measure passed the legislature for the purification or prevention of the pollution of those two rivers, would you think it right to have a local body as well as a central controlling authority, such as the county magistrates or any other body which might be suggested. You would not I presume like to be placed entirely at the disposal of the central authority?—I should think that the measure would be carried out more efficiently by being under the entire control of the central authority, because in many places the magistrates are the very parties who are most interested in works which pollute the river.

15,257. (*Chairman.*) You mean that many of the manufacturers are magistrates?—Yes.

15,258. But I think that from the experience which we have gained in this inquiry, the manufacturers themselves are very willing to carry out a system of prevention, if it can be shown how it is to be done, and if the system is general?—I am glad to hear it.

15,259. (*Professor Way.*) At all events those who themselves suffer from pollution, are not only ready, but anxious for a remedy which shall be applied to them simultaneously?—Many parties are anxious for remedies so long as they do not cost them anything, but if the remedy is a costly one they are not so eager to carry it out.

15,260. (*Chairman.*) Have you observed the works of the Airedale Improvement Commissioners?—I am one of the deputy commissioners.

15,261. Have you heard the evidence which has been given to us by Mr. Bradley?—Yes.

15,262. Do you corroborate that evidence?—I cannot say that I do in every respect.

15,263. In what respect do not you corroborate it?—I think that the whole scheme has been imperfectly carried out. The original design was a very good one, and had it been carried out it would have been a very great advantage to the valley, but it was only partially carried out, and at a cost considerably above the original estimate.

15,264. Then you think that there has not been so much improvement as there might have been?—By no means.

15,265. Do you think that there has been an improvement to a certain extent?—An improvement in some places and an injury in others.

15,266. Within the district of the Commissioners?—Yes.

15,267. Some parts of the valley are benefited at the expense of other parts?—Just so.

15,268. Do you think it probable that persons residing below Keighley have any ground to complain that, speaking generally, these improvements have been made at their expense?—I know very little of the country below Keighley; that is a thing which I cannot speak to.

15,269. But the water being passed off more rapidly from this district, may give rise to greater flooding below?—It is passed off more quickly from the upper and middle portions of the district, but lodges in the lower portion about Silsden.

15,270. Does not it pass off more quickly?—In some localities it does, and in others it does not. We have lands flooded now which never used to be flooded before.

15,271. Do you agree with Mr. Bradley as to the improvement in the health of the people residing upon the banks?—Yes, I believe that the work has had a good effect, especially about Kilwick and Cross Hills; they have derived more benefit than any other districts, because the surface of the river has been lowered to the extent of 10 feet by the removal of shoals; shoals are accumulated at the junction of the streams with the river to an immense extent, those districts have been very much benefited both agriculturally and in the health of the inhabitants.

15,272. Have you observed the action of the gravel traps?—I have.

15,273. Is it satisfactory?—So far as they go they act very well, but they are expensive.

15,274. What do you expect as a commissioner to have to do with the gravel which is collected in them?—I think that the gravel could be sold for different purposes; the larger gravel could be sold for road metal, and the smaller gravel and sand could be sold for garden and building purposes.

15,275. Do you think that there would be a sale for it?—Yes, in most districts.

15,276. Of course all that you can keep out of the river Aire is an improvement to the river generally?—Yes, it is of immense importance that the gravel should be trapped, because the shoals have been removed at very great cost, and they are now forming again in many cases.

15,277. You commissioners, I presume, are a continuous body?—Yes.

15,278. And it will be your duty to remove those shoals after such a flood as this?—Yes, we should do it.

15,279. Have you power to raise a rate upon the adjoining land for such purposes?—Yes, full powers.

15,280. Within what area does that power exist?—I think that the area is 1,200 acres.

15,281. How is it defined?—By plan and schedule.

15,282. Made before the works were executed?—Yes.

15,283. (*To Mr. Bradley.*) You have heard the observations made by Mr. Nicolson as to the improvement of portions of the valley by the works of the Airedale commissioners, and the injury done to others?—Yes. I presume that Mr. Nicolson means by the part which is not improved, some part where the works are not yet finished. I was asked the other day by Mr. Sidgwick, who is one of the commissioners, to go down to the Holden beck to observe the action of the river there, that was before the flood, and to see what I thought about a cutting being made there to relieve the land which has been referred to. It appears pretty clear that the actual drainage of that part of the valley is defective yet, but that by removing the impediments at the foot of the stream it would be considerably improved. I suppose that Mr. Nicolson refers to that point.

15,284. (*To Mr. Nicolson.*) As I understand you, your argument is this, that in the first place the works were very well designed, and that if they had been fully carried out you think that the result would have been beneficial to the whole of the valley?—Yes, very much so.

15,285. But you say that they have only been partially carried out, and that therefore they benefit some parts at the expense of others?—Just so.

15,286. Your argument would go to this, that the whole should be carried out as originally designed?—They have unfortunately in some places departed from the original design.

15,287. In order to diminish the expense?—Yes.

15,288. But that, I presume, was done with the consent of the whole commissioners?—With the consent of a majority of them.

15,289. Was the original design subject to the supervision of any Government officer?—No.

15,290. It was done by Act of Parliament?—Yes.

15,291. Have you under that Act the power of carrying out a part of the works or of altering them?—I cannot speak to that point; I think that it is questionable.

15,292. You are aware that there is now a land drainage commission; you know the Land Drainage Act which was passed a few years ago?—I do.

15,293. Commissioners are appointed under that Act?—Yes.

15,294. And changes made in drainage such as this, would now be submitted to them. An officer of the commission would be sent down to examine the locality and to say whether the plans were sufficient, and I rather think that the works must be carried out in accordance with those plans. You would approve of such a system in preference to this Act of Parliament under which you are now acting?—Decidedly, because works are too often made to suit estimates instead of public utility.

The witness withdrew.

SKIPTON.

Mr. JOHN CALVERT (Skipton) further examined.

Mr. J. Calvert.

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15,295. (*Chairman.*) You have heard the evidence which has been given by Mr. Nicolson?—I have.

15,296. You mentioned that you could supply, and did supply about 100,000 gallons a water a day to the people of Skipton?—That is about the average.

15,297. Mr. Nicolson mentions to us, that in the summer time you cannot supply that volume of water?—In a very droughty summer we could not supply that quantity.

15,298. What quantity were you enabled to supply in the summers of 1864 and 1865?—We were able to give a supply of five hours a day for two months, and for the remainder of the time a full supply.

15,299. Was that the case in each year?—In each of those two years.

15,300. (*Professor Way.*) Five hours each day would be one-fifth of the usual supply?—Yes.

15,301. It would be four gallons per head at that time?—Yes.

15,302. (*Chairman.*) Have you any note of the volume of water which was actually drawn off on those occasions each day for the use of the day?—I have not the particular measurement of it, but I have a certain mode of knowing what quantity of water passes each day into the town.

15,303. What was it then?—It would be about one-fourth of the quantity which is passing into the town at this time.

15,304. One-fourth of 100,000 gallons a day?—Yes.

15,305. That is 25,000 gallons a day?—Yes.

15,306. (*Professor Way.*) Is that the minimum on any one day?—Yes, during the time of the greatest drought.

15,307. That is the minimum supply during the driest time?—Yes.

15,308. (*Chairman.*) That would be five gallons per head per day?—Yes.

The witness withdrew.

Mr. T. Clarke.

Mr. THOMAS CLARKE (Skipton) examined.

15,309. (*Chairman.*) You are fireman of the gas works at Skipton?—Yes.

15,310. How many years have you been so employed?—About 17 years.

15,311. Where are the works situated?—At the railway station.

15,312. How many retorts have you?—24.

15,313. What quantity of coal do you use in a year?—1,000 tons I think is now the average.

15,314. What quantity of gas do you manufacture from it?—On the average about 10,000 cubic feet per ton.

15,315. How do you purify your gas?—With dry lime.

15,316. What becomes of the refuse lime?—It is contracted for by the farmers.

15,317. Do they take it away steadily?—Yes.

15,318. Have you at any time any accumulation upon the premises?—No, perhaps I have four or five cart loads.

15,319. You have not so much as to become a nuisance?—No.

15,320. Are your men healthy?—Yes, they are all healthy.

15,321. What becomes of your coke, have you a ready sale for it?—Yes, we can clear it out every day; we have a customer who will take the whole.

15,322. What becomes of the tar and other refuse from your manufacture?—It is contracted for; it goes to Upton, near Accrington, at present.

15,323. Does anything at present go from your premises into the beck?—No, I do not know that there is anything at present.

15,324. You do not pollute the stream at all?—No, all the liquid goes into the tar vats, and the ammoniacal vats.

15,325. And all is sent away for sale?—Yes.

15,326. At what price do you supply gas?—At 5*s.* 5*d.* for the small consumers, and for the large ones 5*s.*

15,327. (*Professor Way.*) Is not that a good deal for this district?—Yes.

15,328. What do you give for your coals?—Some of the coal is 1*l.* a ton.

15,329. But you use a mixture of coal?—Yes; the other coal would be about 14*s.* now, it is a little higher than it was.

15,330. Then the average cost is something like 16*s.* or 17*s.* per ton?—I daresay.

15,331. What do you now get for your tar?—I do not quite know.

15,332. Is it about 1*l.* a ton?—Yes, or rather more.

15,333. What do get for your ammoniacal liquor?—It is rather less; I do not know exactly the price.

The witness withdrew.

Adjourned to to-morrow at 11 o'clock at Pontefract.

Pontefract, Friday, 30th November 1866.

PRESENT:

ROBERT RAWLINSON, ESQ., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, ESQ. | Professor JOHN THOMAS WAY.

PONTEFRACT.

JOHN ROUTLEDGE, ESQ. (Pontefract), examined.

J. Routledge, Esq.

30 Nov. 1866.

15,334. (*Chairman.*) Are you mayor of this borough?—Yes.

15,335. What is the population?—About 5,346.

15,336. This is a very ancient corporation?—Yes; it dates from the year 1484. It was incorporated by Richard III. in the second year of his reign.

15,337. Do you know the rateable value of the borough?—About 15,000*l.*

15,338. It is both a municipal and a parliamentary borough?—Yes, and it returns two members to Parliament.

15,339. Are the areas of the municipal and parliamentary boroughs the same?—No, they are different.

15,340. How is the local government of the borough carried on?—By the corporation and the street commissioners.

15,341. The street commissioners are an independent body?—Quite so.

15,342. You have not yet adopted the Local Government Act?—No.

15,343. You act under your old charter?—Yes.

15,344. The street commissioners, I assume, are a self-elected body?—Yes.

15,345. How many are there?—33.

15,346. Is the body regulated by a private Act of Parliament?—Yes.

PONTEFRACT.

J. Routledge, Esq.

30 Nov. 1866.

15,347. Have you carried out any system of sewerage in this town?—Yes.

15,348. Where is the outlet?—It runs into the canal.

15,349. What canal?—The Goole canal.

15,350. Then the main sewer empties itself into the canal?—Yes.

15,351. Have any complaints been made of this state of things?—No.

15,352. Are you quite content to let it go on?—No, for health's sake it ought to be prevented.

15,353. I suppose the canal is not very foul?—No.

15,354. Does the canal merely carry off the surface water of the streets?—The sewage is emptied into tanks at the lower end of the town.

15,355. What goes into the canal?—Part of that sewage.

15,356. The overflow?—Yes.

15,357. Is anything done with the sewage after it goes into the tanks?—It is put upon land occasionally; it consists principally of sand.

15,358. Are any manufactures carried on in Pontefract?—No.

15,359. Then you do not pollute any of these streams by manufacturing processes?—No.

15,360. Nor do you obstruct the streams by any solid refuse?—No.

15,361. You are not inconvenienced by flooding at all?—No.

15,362. Is there a water supply for the town?—Yes.

15,363. In the hands of a company or the commissioners?—The commissioners.

15,364. How long have those works been established?—For 14 years.

15,365. Were they established by Act of Parliament, or are they only permissive?—The street commissioners bought the property and sunk a well; the water is pumped up from a well.

15,366. You are apparently very little interested in the inquiry we are conducting as to the pollution of rivers?—No; we have nothing to do with it.

15,367. As a municipal borough you are not much concerned with it?—No.

15,368. How far is it in a straight line from Pontefract to the river?—About two miles to the point where the sewage runs into the canal. Originally some pipes were laid down to carry the sewage into the river Aire, but those have been blocked up for many years, the scheme never having been completed, and now the sewage runs into the canal.

15,369. It was contemplated, as I understand you, to run the sewage down into the river?—Yes; some pipes were laid down under the canal to be carried into the river.

15,370. (*Mr. Harrison.*) Is Knottingley included in the parliamentary borough?—Yes.

15,371. And Castleford?—No.

15,372. (*Professor Way.*) Did you state that the sewage runs into tanks?—Yes.

15,373. But that it overflows from them?—Yes, and runs into the canal; it has two miles to run before it goes in.

15,374. Is it treated in any way with any substance to precipitate it?—No.

15,375. It merely deposits what it will deposit and then runs off?—Yes.

15,376. Are these tanks large?—Yes.

15,377. What size are they?—I do not know.

The witness withdrew.

Mr. E. Fernside.

Mr. Edwin Fernside (Pontefract) examined.

15,378. (*Chairman.*) What are you?—I am superintendent of the borough police and inspector of nuisances.

15,379. For the municipal borough?—Yes.

15,380. What number of houses are there in Pontefract?—I do not know.

15,381. Eight or nine hundred?—I cannot say. (*The witness subsequently informed the Commissioners that there were* 1,202 *houses in Pontefract.*)

15,382. How long have you acted as inspector of nuisances?—Upwards of 10 years.

15,383. What are your duties?—To inspect nuisances and to report to the sanitary committee.

15,384. Under the Nuisances Removal Act?—Yes.

15,385. Have many waterclosets been constructed in the borough?—Yes, 175 waterclosets have been constructed.

15,386. In what class of property?—Generally in the better class of dwelling houses and public buildings.

15,387. How is the sewage passed away?—It goes into the main sewer, which empties itself into the Aire and Calder canal.

15,388. After passing through some tanks?—Yes.

15,389. Are there many common privies and ashpits in the poorer class of houses?—Yes. There are 736 privies.

15,390. Where are they situated, generally speaking?—Generally behind the dwelling houses.

15,391. Are any of them placed under sleeping apartments or rooms in which there are occupants?—There are a few, I believe.

15,392. Do not you know the fact?—I know that there are several.

15,393. Do many of the poor people keep pigs?—No; what is called the pig nuisance has been a good deal suppressed by the sanitary committee.

15,394. It was a much greater nuisance than it is now?—Yes.

15,395. Have you caused the nuisance to be removed?—Yes.

15,396. Do the corporation take any cognizance of buildings about to be erected?—No.

15,397. Does anyone build a house as he likes?—Yes.

15,398. Have you ever to complain of buildings being too much crowded together on a given space of ground?—I have had occasion to complain of some of the lodging-houses, of people keeping lodging-houses without being duly registered or licensed, and in such cases the offenders have been brought before the magistrates and punished under the provisions of the byelaws.

15,399. How many common lodging-houses are there within the municipal borough?—18.

15,400. For how many lodgers are they registered?—I can produce my register; I cannot say from memory.

15,401. Let me look at your register (*the same was handed to the Chairman*). Do you find any difficulty in carrying out the powers of the Act?—None whatever.

15,402. When you first commenced to put the Act in force did you find any difficulty?—No.

15,403. In what condition are the lodging-houses now as compared with what they were when you first began?—They are in a very satisfactory state.

15,404. Better than when you first began?—Yes, they are cleaner.

15,405. Do you compel the tenants to whitewash them when they require it?—Yes.

15,406. How many times a year?—Twice a year.

15,407. Do you also see that there is proper ventilation to the rooms when occupied?—Yes.

15,408. And a proper separation of the sexes in the lodgings for single persons?—Yes; under the recent Act of Parliament every day every lodging-house in the town is visited, and a report is made out similar to that (*handing in the form*).

15,409. I perceive in this return that one house is licensed to take in 32 persons?—Yes.

15,410. Another is licensed to take in 12?—Yes.

15,411. Another is licensed for six, another for eight, and another for ten?—Yes; this (*handing in the same*) is a copy of the printed regulations.

15,412. A great many of the lodgers, I believe, are not what you would term vagrants, but men on the tramp?—Very many of them are.

15,413. You have hawkers, labourers, gasfitters, tailors, shoemakers, saddlers, glass blowers, and an ink-maker and his wife. These are persons moving from one town to another on the tramp seeking for employment?—Yes.

15,414. They go to these lodging-houses as the only place of resort they have?—Yes.

15,415. What have they to pay a night?—3*d.* a night.

15,416. I suppose they are made to pay before they go upstairs?—Yes, I believe that is the rule generally.

15,417. What are the nuisances that trouble you most in this town?—The street grates are perhaps the greatest nuisance I have to contend with.

15,418. You mean the gullies?—Yes.

15,419. Do you perceive a bad stench arising from them?—Yes.

15,420. Do you know what shape the sewers or the drains are, square or circular?—The main drain is egg-shaped. I mean the new one.

15,421. When was it made?—It was made a few years before I came here, which was in 1856. I think it must have been in 1853 or 1854.

15,422. Of what shape are the tributary drains?—They are generally circular, I think.

15,423. Would you not infer that there must be something foul in the drains that causes the smell to come up through these grates?—The smell coming from the grates I would account for in two ways. In the first place, there is not a sufficient quantity of water to flush them out properly, and in the next place I think that they might be improved materially if a shaft was constructed to take away the foul air.

15,424. Do you think that the sewers are not properly ventilated?—Yes.

15,425. Are complaints ever made to you of bad smells getting into houses through waterclosets?—Yes, frequently in summer time and fine dry weather.

15,426. And occupants are suffering annoyance inside their houses?—Yes.

15,427. Have any complaints been made of nuisance arising from the outlet tanks into which the sewage goes?—No.

15,428. Whose duty is it to empty the ashpits?—They are emptied by private individuals, the owners or occupiers.

15,429. You do not empty them on behalf of the borough, but you give the parties notice to do so if the privies get very foul?—Yes.

15,430. Are the contents taken by farmers out into the country?—Yes.

15,431. Are there many slaughter-houses in the town?—I believe about half a score.

15,432. Have you much trouble with them?—Very little.

15,433. Are they drained into thesame sewer?—Yes.

15,434. I suppose the washings from the slaughter-houses, the garbage, and blood are all carried away?—Yes.

15,435. And pass down to the outlet?—Yes.

15,436. If such matter as that were to accumulate in the drains in hot weather I suppose it would help to produce a bad smell?—Yes.

15,437. During last summer did you use any disinfectant of any kind?—Yes.

15,438. Was that provided by the corporation?—Yes.

15,439. What disinfectant did you use?—Carbolic acid and chloride of lime.

15,440. Was there any cholera in the town during last summer?—I believe not a single case within the borough.

15,441. Has there been any fever of any kind?—Yes, a sort of low fever has been rather prevalent amongst cottagers.

15,442. Has there been any fever near any of those places where you say bad smells have been complained of?—Not particularly.

15,443. Where does fever usually occur?—I have known it to occur in very well ventilated houses and in healthy neighbourhoods. It has not been confined to the worst-drained districts.

15,444. Does much fever occur in the common lodging-houses?—Not very much.

15,445. Did you know those lodging-houses before they were registered?—Yes, some of them.

15,446. They were not under your supervision then?—No.

15,447. How long have you been in the police?—18 years.

15,448. Did your duties ever take you into those common lodging-houses 18 years ago?—Yes.

15,449. What condition were they in then?—I was not here at that time; I was in the Cheshire county constabulary before I came here, but I consider that the lodging-houses are very much better now in consequence of the daily visit that I cause to be made to them.

15,450. In order to see that the tenants comply with the regulations which are pasted up in each room?—Yes.

15,451. Do the lodgers ever draw your attention to the regulations, and point out to you that they have not been properly carried out?—Yes, in one or two instances, but not as a general thing.

15,452. Have they ever complained of the bedding being dirty?—No. The last complaint that I heard was of a male and female sleeping in one room. It is contrary to the provisions of the byelaws, and the parties were summoned before the magistrates for allowing it.

15,453. By whom was that complaint made?—By a fellow-lodger.

15,454. Male or female?—A male.

15,455. (*Professor Way.*) Do you find that carbolic acid is a good disinfectant?—I like the lime better.

15,456. Does the effect of carbolic acid soon pass off?—No, not very soon.

15,457. What is your objection to it?—It has been tried here by the medical inspector, and he said that he thought lime was better; I thought so too.

15,458. Is it used in the urinals?—Yes, and in the ashpits and privies; it is also put down the grates.

15,459. Is it put down through the gratings?—Partly so.

15,460. Is it also put down into the gully holes?—Yes.

15,461. (*Mr. Harrison.*) Where does the canal lead into which the sewage is discharged?—It is what is called the Aire and Calder canal, and it leads to Goole from here; it is between Goole and Leeds.

15,462. Does it go down to Knottingley?—Yes.

15,463. Does it pass through the town of Knottingley?—Yes.

15,464. The canal which passes through the town of Knottingley receives the overflow of the sewage of Pontefract?—Yes.

15,465. It does not reach the Ouse till it discharges at Goole?—I think it is connected in some way with the river.

15,466. Would it not foul the water more or less all the way from this to Goole?—Yes, I think so.

15,467. Have any complaints been made at Knottingley of the condition of the canal in consequence of the sewage of Pontefract being turned into it?—I never heard of any.

The witness withdrew.

Mr. Joseph Horn (Castleford) examined.

15,468. (*Chairman.*) Are you the proprietor of certain mills in the town?—Yes.

15,469. What business do you carry on?—Flint grinding, and the manufacture of whiting.

15,470. Where are the works situated?—One at Oulton and the other at Castleford.

15,471. What power do you use?—It is water power at Oulton and steam at Castleford.

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15,472. What amount of water power do you use?—It is called a 20-horse water-wheel.

15,473. Where does the water come from?—From the river Aire; the mill is on its banks.

15,474. Do you get the water by a side cut?—No, from the river itself; we have a goit.

15,475. Is there a weir across the river at that point?—Yes.

15,476. What fall is there to it?—About 7 feet 6.

15,477. Of what width is your wheel-race?—8 feet 4 inches I believe, or 8 feet.

15,478. The wheel, I suppose, is ground shot?—About half way up, nearer the centre than the bottom; I think it is 18 feet, the power is obtained underneath.

15,479. How long have you worked that wheel there?—I went there it will be 30 years ago in April next; we began to work the wheel then. I have been away since then.

15,480. Is the power as good now as when you first began to work it?—I do not know that there is any difference in it.

15,481. Does your tail water get away as readily as it did?—Yes, much the same.

15,482. Then the river has not altered in its character so as to injure your power?—I think not.

15,483. Is the river navigable now?—No; now they have the canal. The river used to be navigable above 30 years ago, but they cut the canal at the same time, I believe, as the Goole canal.

15,484. Is the river bed raised above you or below you?—Yes, they have to dredge sometimes for us, so that we can get a boat down to the mill.

15,485. The river is kept in order by dredgers at its proper depth?—Yes, only just at that point, about 100 yards from the lock down to the mill.

15,486. Is the river polluted by manufacturing refuse thrown in above you?—Yes.

15,487. By what is it polluted?—The greatest cause of the pollution is the Leeds sewage.

15,488. The sewage of Leeds comes down to you?—Yes, and since that has been put in we cannot get any fish; before that we could get quantities.

15,489. The sewage has killed the fish?—I suppose so.

15,490. Do you know when the Leeds outfall sewer was completed?—I do not know exactly. I left the Fleet mills about 18 years since, and the sewer was not in then, but when I went back again seven years since it was in.

15,491. Do you think the river is more polluted now than it was when you first knew it?—Yes, a great deal; I used to bathe in it formerly, sometimes twice a day; we could drink the water then, but I should not like to drink it now.

15,492. Where is the other mill situated?—At Castleford.

15,493. Is that a steam mill?—Yes.

15,494. Is that mill near to the river?—It is close to the river side.

15,495. Why do you use steam power there?—Because we have no fall.

15,496. What amount of coal do you use there per annum?—40 or 50 tons a week.

15,497. What do you do with the ashes?—We put them into a field; we used to put them on the bank-side to fill up.

15,498. Did you ever put them into the river?—They swam into the river in flood time.

15,499. You placed them very convenient for the flood to reach them?—Yes.

15,500. Did any person object to that at any time?—The Aire and Calder Company mentioned it once or twice to me.

15,501. To your knowledge do any persons put ashes into the river in your district?—I do not know that they do; they wash in, I believe, sometimes; but not to make a practice of it.

15,502. Does the sewage from waterclosets or privies go into the river?—At Castleford the sewage runs in.

15,503. Direct?—I believe so. Formerly we had two tanks, but they are done away with now.

15,504. What is the population of Castleford?—About 4,000 now; I am not quite sure about it.

15,505. How long has the manufacture at Castleford Mill been carried on?—The mill was built in 1849.

15,506. What number of men do you employ there?—10 or 11; it is not a very large mill.

15,507. Does the ground flint go into the Potteries?—Yes, for common ware; it is at Castleford and Ferrybridge where it is used, not for glass.

15,508. They use flint dust for bedding the best China in before it goes into the fire?—I believe they do.

15,509. Where does the whiting which you manufacture go?—A good deal of it goes to Manchester, to Leeds, and Halifax.

15,510. Is it calcined limestone?—No, it is ground, washed, and then dried.

15,511. (*Professor Way.*) How do you separate the flint after grinding it; do you put it in water?—First of all we wash it after grinding it, then it goes into a cistern to settle, and then we let the water off.

15,512. How do you dry it?—We put it on to a kiln to dry, but we dry very little; it is generally sent out in tubs.

15,513. And the same with the whiting?—No, that is all sent out dry.

15,514. Did you ever hear of a plan that is used in the Potteries for separating the clay from the water?—Yes, and they use that at Castleford.

15,515. Where is it used?—At Hartley and Company's.

15,516. Does it answer?—I believe that it does to a certain extent, but I am not sure about the name.

15,517. Have you ever seen it used?—Yes.

15,518. The water is forced in from the clay with a pump, is it not?—Yes.

15,519. Do not you think that the machine would be useful in making your whiting?—We could not make the whiting dry enough; we can do it by settling; we pump it on to the kiln to dry, and that is all one trouble of course.

15,520. (*Mr. Harrison.*) How are you supplied with water at the mill?—From the river.

15,521. Is the mill where you use water power on the Aire?—Yes, the water comes from the river; all the water that we use is from the river.

15,522. Do you use the same water also for domestic purposes?—No, we have a well for that.

15,523. Do you get good water from that well?—Yes, it is good water, but hard; we cannot wash with it.

15,524. What depth is that well?—I should think about three or four yards; it is filtered out of the sand.

15,525. Are there many persons residing on the banks of the Aire near to the mill, between Leeds and the junction of the Aire with the Calder?—No, Hunslet is the principal place below Leeds; then there is the Thorpe Hall colliery, and there are, I believe, 50 or 60 houses close to the river side there. Near to the Fleet mill we have 12 or 14.

15,526. Are they generally supplied with water for domestic purposes as you are?—I do not know how they get water at Thorpe Hall, but many persons get it from our pumps at Fleet mills. There are two wells, but ours is considered the best; it is inside the house.

15,527. Is the condition of the river at your mill sometimes very disagreeable?—Yes, it is very bad indeed in dry, hot weather. It is so bad that it glazes the outside of the doors, and inside the mill, and what ought to be white is perfectly black coloured.

15,528. Does it affect the health of the people there?—I cannot say, but I know that in the morning I do not like it.

15,529. (*Chairman.*) Has it any effect upon white paint?—Yes, it blackens it.

15,530. (*Professor Way.*) I suppose you cannot use the water of the river for grinding the whiting?—The water with which we grind the whiting we use over again often. When it is very bad it makes the whiting rather dark coloured.

15,531. You do use it then in the first instance?—Yes.

15,532. Then the dark particles in the water are apt to mix with the whiting?—Yes, and they settle with the whiting.

15,533. In grinding the whiting you run off the finer parts and let the liquid settle?—We have edge stones, and the liquid keeps running out when it gets to a certain height.

15,534. Does the material eventually all get fine?—No, we have a certain part that we grind by another process, not washing.

15,535. You ultimately grind it all down, do you not?—Yes.

15,536. There is no residue from it?—Only what falls on the floor.

15,537. Where does the material come from?—From a place near Hull.

15,538. Is it chalk?—Yes, it is hard chalk.

15,539. Are flints found in the same bed?—No, not those that we use; we use black flints for pottery. Flint out of the same bed would be too coarse.

15,540. Is it a very expensive process to grind flints?—Yes, it requires very strong machinery, and accidents often happen.

15,541. Are the flints ever calcined before they are ground?—Yes.

15,542. And thrown into water?—No, it would not suit to do that; they would want to be thrown in red hot; if we threw water over we should spoil the kiln.

15,543. The flints would not be red hot when got out of the kiln?—No.

15,544. You have spoken of the pollution of the river by the Leeds sewage, and that that has occurred within the last 20 years?—Yes.

15,545. Has the number of manufactories on the river increased in the last 20 years?—Yes, I should think there are three or four more on the river than there were 20 years ago.

15,546. But I mean at Leeds?—I think there were as many on the river side before, but manufactories have got up the becks.

15,547. Do you think that any part of the increased pollution is owing to the dyeing processes which have been carried on in the last 20 years?—I cannot say. Of course we had the pollution from the dye-houses when I went there first to a great extent, but it is a great deal worse now than it was before the Leeds sewage went into the river.

15,548. You cannot say exactly what causes have contributed to make the river worse?—No; but one thing I can say, which is, that when we are short of soft water for washing purposes we are obliged to take water out of the canal in preference to the river; the water is a great deal clearer in the canal than in the river, for the Leeds sewage comes in below the point where the canal is fed. That strengthens my opinion about the Leeds sewage.

15,549. I suppose the objectionable materials in the canal fall to the bottom to a great extent, whereas when in the river which is in motion they would not fall in the same way?—I cannot say, but a great deal does fall into the river; we have a lock close to us, and in a flood time, as just now, the river is filled up for above a foot outside the lock, and the stuff will not go away of itself; it must be pushed away by boats, or flooded away from the lock.

15,550. (*Chairman.*) Do you break your flints by hand?—No, they are broken by stampers.

15,551. Have you seen the new machine which has been invented for stone breaking?—No, but I have heard of it.

15,552. (*Professor Way.*) Do you use only stampers, or do you use an edge runner afterwards?—No, we only use stampers; we have a grate that the flint particles go through, and when that is done we can grind it.

15,553. You do grind it eventually?—Yes, but we stamp it first. The jaws of the new machine would not make it much finer. Our flint must be almost as fine as cream.

15,554. Do you grind it in water?—Yes.

15,555. (*Chairman.*) Does the pan revolve or the stones?—For flint grinding we have the Derbyshire chert, and we push the chert forward with arms and pave the bottom, and then we have runners at the top and push forward the arms; our stones for making whiting run round; the bottom is a fixture.

15,556. Did you ever see Dr. Clarke's process for softening hard water by throwing lime into it?—No, but we make the water that we use softer by washing the whiting in it.

15,557. The whiting combines with the lime in the water and takes it up if there was any in before?—Yes.

15,558. And the water when it goes away is softer than it was before?—Yes.

15,552. (*Professor Way.*) If you were in a chalk district where the water was hard you might be able to soften the water and get the whiting in proper condition; here it is comparatively soft water?—Yes.

15,560. (*Chairman.*) How much whiting do you make in a day?—Sometimes six tons. There is one nuisance that I think I ought to mention which comes from a brewery about about a mile above us.

15,561. What is the name of that brewery?—Oulton brewery.

15,562. How long has it been established?—I should think about 30 years.

15,563. Is the nuisance you speak of worse now than it was before?—Yes; the volumes of water from the washing of the barrels and the malt and those things is three or four times as big as it used to be; it is almost too much to bear as one is walking by the side of the drain; that refuse goes into the river Aire below our mill at Fleet, but above Castleford.

15,564. How does it happen to be an annoyance to you?—There is a foot road and a cart road which go past the drain, and we have to pass it nearly every day; I mention this because it pollutes the river.

15,565. The refuse is simply, I suppose, the washing of the barrels and the floors and the waste refuse that comes away?—Yes.

15,566. Do they send waste hops down or waste grains with it?—I do not know, but they lead waste hops away to a field which cause a very bad smell.

15,567. Waste hops which are thrown out and then get old and putrid are very offensive?—They are. I know that they smell very badly.

15,568. (*Professor Way.*) I suppose a sour kind of smell is brought down the river from the brewery?—No, but it is very bad; it is not quite so nauseous as the smell from the river, but it is rather worse to bear for the nose; the river smell is more sickening than that from the brewery drain.

15,569. (*Chairman.*) And you say that refuse from the brewery is one of the causes of pollution at present?—Yes; I should say that it makes the river worse for the Castleford people.

15,570. Where do the Castleford people get their water?—At first when I was there a great many of them got it out of the river, and many of them made tea of the river water then, but they cannot do so now I think. We have had several talks about a water supply for Castleford, but they have never got it yet; it is much wanted.

The witness withdrew.

Mr. Henry John Coleman (Pontefract) examined.

Mr. H. J. Coleman.

15,571. (*Chairman.*) Are you town clerk of Pontefract?—Yes.

15,572. In whose reign was your first charter granted?—In the reign of Richard the 3rd.

15,573. You have many charters I believe?—Yes.

15,574. Does the corporation hold any corporate property?—Yes.

15,575. Of what does it consist?—The market-hall and the town-hall.

15,576. Did the corporation acquire the market

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tolls by purchase?—No; they have belonged to them from time immemorial; they were first granted by charter.

15,577. Is the corporation lord of the manor as to manorial rights of Pontefract?—Yes; but the corporation has not exercised any such rights.

15,578. For instance, in taking market tolls?—Yes, they have been granted by charter.

15,579. That is a sort of manorial right?—Yes.

15,580. In other places market tolls are usually paid to the lord of the manor?—Yes.

15,581. Have you the privilege of regulating markets and fairs?—Yes, at least the mayor, who is clerk of the market, has all those privileges.

15,582. Has the market-hall been built out of any surplus fund that you have had, or have you borrowed money for that purpose?—We sold land and raised money in that way. We borrowed money as well.

15,583. Is the income sufficient to pay the current expenses and the interest of the money, and to leave a surplus?—Yes.

15,584. Does the corporation possess any other corporate property?—No.

15,585. Do you make the mayor an annual allowance?—No.

15,586. Of what number of members does the corporation consist?—16, and the mayor; four aldermen and 12 common councilmen.

15,587. Of course you are under the Municipal Corporations Act?—Yes.

15,588. Your corporation was reformed in 1837?—Yes.

15,589. Did that leave you with the same number of members?—No, it increased the number, originally there were 13.

15,590. Of what area does the municipal borough consist in acres?—I cannot say.

15,591. Are the boundaries now what they were before the Municipal Reform Act was passed?—No, they were regulated by that Act.

15,592. Is the municipal area co-extensive with the parliamentary area?—No.

15,593. What is the difference?—It is very great.

15,594. Your parliamentary borough, I suppose, is much larger?—Yes, it takes in all the township of Knottingley.

15,595. Were the limits of the parliamentary borough settled by the Municipal Reform Act in 1832?—No; the boundaries were settled when the Parliamentary Reform Act was carried out.

15,596. Was the borough boundary settled at that time?—Yes.

15,597. Did Pontefract send two members to Parliament before the Reform Act was passed?—Yes.

15,598. It retained its members, and had its area extended to increase the number of voters?—Yes.

15,599. Have you anything to do with the improvement commissioners?—No, I am not their clerk.

15,600. What other property does the corporation possess?—I have mentioned the town-hall.

15,601. Do they own any land now?—No, we sold the land for the purpose of the market.

15,602. Then you have no source of corporate income other than what comes from the rents of the market?—There is the borough rate.

15,603. Is that levied by the commissioners or through them?—No, the rating is done through the corporate body.

15,604. Do you think it is advisable to retain two separate systems of government in one small borough?—I hardly know how to answer that question; there are so many different opinions about it from so many clever men. I do not like to answer it.

15,605. The recent practice has been to consolidate local government under a corporation where it exists?—Yes, and I should think very properly so too in many cases.

15,606. If your corporation chose to adopt the Local Government Act they might, by an order in council, get the commission extinguished?—But that would be very much opposed.

15,607. Up to last session there were 15 local governing bodies in the municipal area of Leeds, but they went to Parliament for a bill, and they are now all consolidated under the corporation?—So I understand.

15,608. You have nothing to do as a corporation with the sewerage of the borough?—No.

15,609. Nor with street cleansing?—No.

15,610. Are the police under your authority and control?—Yes, they are under us, under the watch committee.

15,611. Is the town lighted with gas?—Yes.

15,612. By a private company?—Yes.

15,613. Is the town supplied with water by the commissioners?—Yes.

15,614. The corporation has nothing to do with either gas or water?—No.

15,615. Has the gas company to give you notice when they want to break up any streets?—No, the notice would be given to the street commissioners.

15,616. Do you, as a corporate body, keep a surveyor?—No, we have nothing to survey.

15,617. There are the mayor, four aldermen, and 12 common councilmen, a recorder, and yourself as town clerk?—Yes; but there is a separate Court of Quarter Sessions.

15,618. Do they meet monthly?—Yes, at least they did, and more often than that.

15,619. Have you anything to do with sanitary matters?—No.

15,620. Nor with river pollutions?—No.

15,621. (*Professor Way.*) Is the inspector of nuisances under your control?—Yes, he is.

15,622. Supposing he reports a nuisance connected with the water supply, in what way do you deal with that matter?—I do not know, but if there was a deficiency he might report the matter to the street commissioners.

15,623. Suppose he found that waterclosets had not been sufficiently cleansed?—That he would lay before the street commissioners; they have the sole control over the water.

15,624. Is he an officer of theirs as well as of the corporation?—No; he would act under the sanitary committee, and report the case to that committee; they would take cognizance of that.

15,625. Has such a complaint to go through your hands?—It would come before the magistrates if the parties did not obey the sanitary committee.

15,626. (*Mr. Harrison.*) The sanitary committee I suppose is in connexion with the corporation?—Yes.

15,627. If they interfered they would complain to the commissioners?—I suppose they would do so.

15,628. (*Professor Way.*) In such a case as that the inspector would have to report to a body to which he is in no way subordinate?—He is partly, because the sanitary committee is formed out of the corporate body.

15,629. (*Chairman.*) May the same gentleman be a member of the commission and a member of the corporation at one and the same time?—Yes, that is so.

15,630. Then the mayor may be mayor of the borough and chairman of the commissioners if so elected?—Yes, and it often happens; I believe that the present mayor is one of the commissioners.

15,631. I assume that the commissioners take their seats by qualification?—Yes.

15,632. They qualify as ratepayers and owners of property?—Yes.

15,633. Is there a double qualification?—No; there is a certain number of persons who are eligible, those who are most highly rated to the poor.

The witness withdrew.

Mr. Thomas Wordsworth (Pontefract) examined.

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15,634. (*Chairman.*) Are you one of the street commissioners?—Yes.

15,635. How many members constitute that commission?—Thirty-four for Pontefract and four for Tanshelf; they all manage the park, but the streets are under the control of the Thirty-four Pontefract commissioners.

15,636. Do they act under a private Act of Parliament?—Yes.

15,637. What is the date of your last Act?—It was about 80 or 100 years ago.

15,638. Is the sewerage of the borough under your charge?—Yes.

15,639. And the paving?—Yes.

15,640. And the cleansing?—Yes.

15,641. Do you exercise supervision over the lighting?—No; except that we pay for the lighting, and we contract for the gas and require the parties to fulfil their contract.

15,642. That is to say you enter into contracts with the gas company?—Yes, for lighting the streets.

15,643. Do you act with regard to the rating in conjunction with the corporation?—No, independently.

15,644. Are you a member of the corporation as well?—No.

15,645. Is there a surveyor employed under you?—No.

15,646. Have you any idea what money you expend in rates for town purposes?—About 900*l.* a year.

15,647. If you have no surveyor, how do you manage with regard to paving and cleansing?—The executive, who are appointed at the first annual meeting, manage that; we manage it amongst ourselves as commissioners.

15,648. Do you elect the improvement committee?—There are three whom we call the "executive," and who are elected every year.

15,649. I suppose your accounts are properly audited?—Yes.

15,650. Have they to be laid before an annual meeting of the commissioners?—Yes.

15,651. Not before any outside body?—No.

15,652. Have you to account to any persons?—No.

15,653. Not to the corporation?—No.

15,654. Only to yourselves?—Yes.

15,655. Are you elected by the ratepayers?—A number of those most highly rated, having freehold property, become commissioners.

15,656. That is if they choose to qualify?—They always do. I never knew an exception.

15,657. If they do not choose to qualify there is no compulsion?—I believe not.

15,658. Would their names be put upon the list of commissioners as the largest ratepayers, whether they chose to act or not?—Yes; the clerk makes out a list annually, and invariably the new members appear and take the oath which the Act requires.

15,659. They are summoned when they are put on the list, and they usually attend?—Yes.

15,660. Has any discussion taken place as to the propriety of vesting larger powers in the corporation?—Yes, about two years ago, and the great majority of the commissioners refused to relinquish their claim to the powers they exercised.

15,661. Have any complaints been made to you, as the board of commissioners, with regard to the outlet sewer that has been spoken of, and as to the tanks?—No.

15,662. You have a public park, have you not?—Yes.

15,663. Of how many acres does that consist?—About 360.

15,664. Is that part of some common that existed formerly?—Yes.

15,665. How long has it been made into a park?—I think 150 or 200 years.

15,666. Is the right to the soil vested in the commissioners; is it their freehold absolutely?—No. I cannot give the legal term, but I think it was a gift to the town for a certain purpose from the Duchy of Lancaster in some former period.

15,667. Could you build upon it, or lease it for building purposes?—No, I believe not.

15,668. You can only use it for park purposes?—Yes.

15,669. Are cattle grazed upon it?—Yes.

15,670. Who has that right?—Every inhabitant, after three years residence, has the privilege of putting on one cow or one horse; for a cow 12*s.* are paid, and for a horse a guinea.

15,671. They have to pay that?—Yes.

15,672. Are there many applicants for that privilege?—Yes, there are about 280 every year.

15,673. Can you accommodate that number upon that acreage?—Yes.

15,674. The funds collected, I presume, go to maintain the park?—Yes, for manure and herdsmen, and to make little improvements.

15,675. Is there a surplus from that source that can be applied for any other purposes?—No; if there is any surplus it is spent in manure.

15,676. For the land?—Yes.

15,677. Is any portion of it ploughed up?—No, it is all grass land.

15,678. Is the park laid out ornamentally?—There has been a little done in the past few years, and I think there will be more done.

15,679. Who is the lord of the manor here?—The Earl of Harewood.

15,680. Could you as commissioners break the surface for the purpose of getting gravel or clay, or rock, or if there was coal underneath could you work it?—The Act is very clear as to what the duties of the commissioners are, and I think we could not.

15,681. In the event of your wishing to carry out any system of sewers should you employ a surveyor or architect to devise and lay out the works?—Yes.

15,682. To see that they were properly executed?—Some one would be appointed if it was a large undertaking, but if it was only a trifling thing costing 20*l.* or 30*l.*, or 50*l.*, I think not.

15,683. Did you hear the inspector of nuisances state that he thought the sewers were not properly ventilated?—Yes.

15,684. Have you as commissioners power to remedy that state of things?—Yes.

15,685. Would it be worth your while, do you think, to bring that before the Commission, quoting the opinion of the inspector of nuisances, which I can very strongly confirm, that if there is no ventilation, ventilation should be made?—I believe that our great defect is want of water.

15,686. If you have foul gas in the sewers, which escapes through the gratings, you do not make it less by confining it, but you intensify it and make it more deadly, whereas, if proper openings were made to allow the gas to escape, less mischief would arise from it?—There has been a talk amongst the commissioners about building a chimney in some part, but it has never been accomplished yet. The commissioners are anxious to do everything they can for the good of the town, and they always have been.

15,687. I may state that unventilated sewers are simply dangerous abominations?—The complaints about the grates have been very trifling. I am aware that there have been some.

15,688. Any town that is sewered and drained, but in which the sewers are not ventilated, is in a worse condition than if it had all its refuse on the surface of the streets, and if bad smells escape through the gratings and gully-holes it is a certain proof that the sewers are not fully ventilated?—I am aware that some complaints have been made.

15,689. (*Mr. Harrison.*) At the present time you turn the sewage into the canal, and that canal passes through Knottingley?—Yes.

15,690. And consequently the canal must be more or less a nuisance to that place?—Yes.

15,691. Has the attention of the commissioners

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been directed to the advisability of carrying the sewage on to land instead of into the canal?—I believe that the water is tolerably clear after it leaves the tank; the refuse remains in the place, which is cleaned out occasionally when required.

15,692. Is there any land in the neighbourhood suitable for irrigation?—I think there might be.

15,693. Do you think the sewage might be applied to land without difficulty?—I think so.

15,694. Where do you get your water supply?—From a well in Tanshell.

15,695. Do you pump it?—Yes.

15,696. What volume of water do you pump daily?—About 50,000 gallons.

15,697. And that is distributed among a population of about 5,000?—Yes, including Tanshelf, about 6,000. Then we have another source; perhaps from 10,000 to 15,000 gallons run into the town from the old source, from a well at the opposite side of the hill.

15,698. Do you find that daily supply sufficient for domestic purposes and for cleansing waterclosets and sewers as well?—It is not quite sufficient.

15,699. What steps, if any, are the commissioners taking to improve the water supply?—They are taking none at present. Formerly the town was supplied with other water, and there were many private wells containing pretty good water too, but the town was supplied from that source alone. About 14 years ago a well was sunk and works erected; it is 13 yards deep, but the rock is about 16 yards high.

15,700. What is the quality of the water?—I do not know, chemically speaking; the water is from the limestone.

15,701. It is hard water?—It is hardish water.

15,702. Whether you discharge the sewage into the canal or into the river is not the act the same, and ought not any measure which the Legislature may pass to prevent pollution by sewage be made to apply not only to towns casting their sewage into running streams but to towns casting their sewage into any channels containing water?—Yes.

15,703. (*Chairman.*) Do you know that the water which flows from the sewage in the tanks, and which flows away bright in appearance, has still all the elements of sewage in it?—No doubt it has.

15,703*a*. And that in no respect has it been altered in its character, except that it has parted with some solid ingredients?—Yes, that I can believe.

The witness withdrew.

W. Wood, Esq.

WILLIAM WOOD, Esq. (Monkhill House, near Pontefract), examined.

15,704. (*Chairman.*) Are you resident near Pontefract?—I live just outside the municipal boundary; practically I am in Pontefract and surrounded by that township. I live near the station; Monkhill is a small township of four or five acres in the county of York, but surrounded by the township of Pontefract.

15,705. You are, I believe, acting as a county magistrate in this part of the riding?—I am, and am chairman of petty sessions at Pontefract.

15,706. At one time you were member for Pontefract?—Yes, in the Parliament elected in 1857.

15,707. Do you know anything of the main sewerage of Pontefract?—Yes, I am a native of Pontefract, and I know it pretty well; there is a main sewer only on one side of the town; the other side of the town, the north side, is not sewered at all, excepting by a branch sewer which is emptied into a stream on the north side of the town.

15,708. And the sewage pollutes that stream?—Yes, all the sewage on that, the north side of the town, is deposited in the stream where it runs over a very flat swampy district which was formerly and is now known as the mill-dam. The water is dammed up there, and in the summer time it is excessively offensive; in my opinion the state of the stream is highly dangerous; there is a most decided stench arising from it, and there are very large deposits of sewage.

15,709. Has there been any attempt made to utilize any portion of it?—Until a few years ago they had for the sewage on the north side a small receiving tank in a garden with no masonry or brickwork, and in that the sewage was caught, and some liquid overflow ran out; but two years ago this depositing tank was one away with, and the whole of the sewage was taken down to a running stream, which a few years ago was a clear stream. It runs through some ground of mine, a small park in front of my house, where the water was perfectly clear a few years ago, and last year I received notice from the Mayor of Pontefract, as chairman of the sanitary committee, to clean out this running stream. He called it an offensive drain, but it had become so chiefly by the act of the local authorities, the street commissioners.

15,710. Then they first committed an injury to the stream, and then they added insult to it by asking you to clean the drain out?—Yes. I wrote to the mayor and stated that one portion of the governing body of Pontefract had committed a great offence towards me, and a great nuisance, and then another portion of the governing body called upon me to remedy it. I requested the Mayor to put a stop to this, but I have received no reply to my letter. I called upon him to stop this matter as chairman of the sanitary committee. I believe that the sanitary committee have a right to bring the street commissioners before the magistrates, who have power to deal with them.

15,711. This is a small stream, is it not, arising from springs chiefly?—Yes, partly from springs in that neighbourhood, and there is a stream also from Tanshelf valley. Then the Lancashire and Yorkshire Railway Company made a cutting between Pontefract and Wakefield, and much spring water comes down from that; it is a very fine, nice stream of water, but, as I have said, it has been ruined chiefly by the street commissioners of Pontefract who have charge of the sewerage.

15,712. If they would do their duty, and properly sewer Pontefract, and deal with the sewage in a sensible manner, that stream might be restored to its original purity?—Yes; it is of itself very pure water.

15,713. If they would do as has been done in other places, in cases which I could cite, that which is now a polluted stream by their own act would be restored to the state in which it was at first, a pure pellucid stream?—Yes; it would not be six hours before it was a pure stream, if the sewage was kept out. There are no sewerage works on the north side except the branch sewer which is taken directly into the running water of the stream by the authorities of the town.

15,714. Is there a considerable fall in this stream as it enters your property?—Yes, there is a very good fall just before it enters my property, it falls from the bridge; there was formerly a small mill there; it is called the mill-dam, but the great deposit is just above my property, which I consider to be highly dangerous, because it covers a large flat, and gives off deleterious exhalations.

15,715. Is your property purely ornamental?—Entirely so; there is a small grass park in front of my house.

15,716. It is perhaps not a place where you would like any experiment to be tried in applying sewage to grass land?—The levels would permit of it, but I cannot say I should like it in front of my house; part of it is immediately in front of my house.

15,717. Although the application of the sewage might produce very heavy crops of rye grass, yet you apprehend that it would be a nuisance to you?—I fear so, and besides that part of the place is close to the houses of the poorer part of the population who live in the old part of the town. There have been many cases of fever there, which I believe have been produced by this deposit of sewage.

15,718. For what distance does the stream traverse your ground?—It goes across my grounds for about 800 feet.

15,719. Then you would not, I suppose, approve of a conduit to take away the sewage past you out of the brook, as it would at the same time take a certain amount of the brook water, and perhaps dry the brook up?—I should not like such a conduit.

15,720. You want to have the brook in its original purity?—Yes; I keep cattle on the land, and I do not know how they are to drink out of the offensive drain, as it has been termed; before the pollution it was good water.

15,721. When did the authorities of the town first begin to make this drain so offensive?—Some small part of the liquid sewage has been, I believe, for a long time turned into the stream, but, as I have stated, up to about two years ago they had a depositing tank in a garden, and the sewage was got out for manure; the overflow then ran down to the water, but the result was not nearly so bad as now; two years ago they did away with the depositing tank and made a culvert, and that passed the sewage directly into the stream.

15,722. I suppose you are aware that you have a remedy against the commissioners?—Yes; but I do not wish to act unneighbourly. I was in hopes that the evil would be remedied, and I wrote to the mayor to that effect, but I fear they will not do it unless they are compelled.

15,723. If in consequence of the report made by this Commission Parliament should think fit to pass any measure for a general conservancy of the streams of the country you would then be protected under a general law, and you would prefer that to being compelled to take proceedings against your own townsmen?—Yes, I should very much prefer it. In the other case I should have to prosecute the street commissioners collectively and individually, as what I have complained of is not only done by them as a body, but it is also done by individual members of the body; the example being set, some of them turn the contents of their own private drains into the stream; they have recently begun to do that.

15,724. You would have to engage in a personal contest with your neighbours, and to fight a body who would put their hands into the public pocket for money to meet the expenses, while you would have to meet them out of your own pocket?—Yes.

15,725. You have made this statement not with the view of casting personal censure upon any persons, but to show that a public evil exists, by which private damage has been inflicted upon you?—Yes, very great injury.

15,726. Although the corporation are not the offenders, yet they turn round upon you and ask you to remedy the mischief which the commissioners have done to you?—Yes. I have an order here, which is signed by the mayor, calling upon me to clean out the stream which has been fouled by what others have deposited in it, and which passes through my grounds.

15,727. Is the land on both sides of this stream your own?—Partly so; in the other part the stream is the boundary of my property.

15,728. Is the bed of the stream claimed jointly by the owner of the adjoining property?—I have claimed it, and I have occasionally cleansed the stream out. I bought it from the Earl of Harewood.

15,729. Is there a fence on the opposite side to you?—Yes; but there is no fence on my side by the stream.

15,730. Do you claim a right to the soil in the stream?—Yes, a right to the water and a right to the soil. I would suggest that in any provision that may be made by Parliament there should be a body constituted independent of the local authorities to enforce the removal of nuisances, for I am sure if it is left to them you will not get the work done. I may add that the sewage of the south side of the town is not deposited in the canal directly; it is put into the stream a mile or a mile and a half from the canal, and then the stream flows down and joins the canal at Ferrybridge, and so the sewage deposits in the canal.

15,731. The sewage has passed through certain streams, and these ultimately find their way into the canal?—Yes. I think that Mr. Wordsworth stated that below these tanks there is no offensive matter, but if you go to Knottingley and walk along the side of the turnpike road after the sewage has left the tanks you will find that there are very large deposits, and that the stream is very offensive indeed.

15,732. (*Mr. Harrison.*) Your evidence goes to show that in any Government measure it will not be merely large streams, such as the Aire and Calder, that must be dealt with but the tributaries, even such small ones as those which come to Pontefract?—Yes, of course they are the source and origin of the main streams, and if you do not deal with the small streams, and there are a number of them, you will have an aggregate of great evils in the main streams.

15,733. In a town like Pontefract, situated not immediately on the banks of a river, but on small becks, where the sewage from the town is turned into these small becks, there is a considerably greater nuisance than would be the case if the sewage were immediately sent into the Aire, where a large volume of water was passing?—I think the nuisance is very much greater, and there is no doubt that you must deal with the small streams as well as the large ones.

15,734. Have you considered at all what arrangements should be made for the management of rivers and keeping them in a pure state?—I have read the report of the commissioners, and a question has arisen in my mind, and I confess it is rather a difficult one, as to the appointment of inspectors; for instance, under any arrangement that might be made I scarcely know to whom you could delegate the appointment. I have long acted as a magistrate in the West Riding, and I have observed that when there has been an appointment to be made by the magistrates, and especially if there was a very good salary attached to it, it did not follow that the fittest man was appointed, but it was he who could raise the largest amount of county influence.

15,735. To whom would you delegate the power of appointing inspectors?—That is a difficult question to answer; partly, perhaps, to the county magistrates, and partly, perhaps, to the Government, but I would prefer the Government as a whole.

15,736. You think there should be government inspectors, similar to inspectors of prisons and factories?—Yes, I think it is absolutely necessary to have some power and authority independent of and above the local authorities.

15,737. Do you think it would answer to have inspectors appointed by the local magistrates, and to impose on those inspectors the duty to examine and report and give information as to offenders?—I should doubt it if the inspectors were appointed by the local magistrates, or any local authorities at all. I have no faith in local authorities for such purpose. I do not think that you would have the law regularly carried out unless the authority was exercised by some central organised body.

15,738. (*Chairman.*) The Secretary of State for the Home Department appoints the magistrates, does he not?—The lord lieutenant of the county first recommends, and then the recommendation is ratified by the Lord Chancellor. I am speaking now of county magistrates. The recommendations for borough magistrates are I believe ratified by the Secretary of State for the Home Department, but the magistrates are appointed by the Lord Chancellor frequently from political party motives.

15,739. Are the county constabulary subsidized by the Government, or are they paid entirely out of the county rates?—They are paid entirely out of the county rates, excepting that a certain portion—I think a fourth in some cases—is allowed by the Government out of the consolidated fund.

PONTEFRACT.

W. Wood, Esq.

30 Nov. 1866.

15,740. Has any government official anything to do with the appointment or removal of the chief superintendent of police?—No; that is entirely in the hands of the county magistrates. The chief constable is appointed by the magistrates of the riding.

15,741. Would it be an advantage if the Government had the appointment of the chief constable?—I do not think it would be a disadvantage. The county magistrates would not like it, but I think it would be no worse, perhaps better, for the public interests.

15,742. In the event of any legislation taking place to prevent pollution of rivers, and an elective representative body being constituted, with power to levy rates and find funds for carrying out necessary works, do you think it would be right that the Government should nominate a surveyor to see the law properly carried out?—I think so.

15,743. Do you think that would prevent local jobbery?—Yes, if he had sufficient power; I think that very likely there would otherwise be local jobbery. Moreover, in dealing with these matters, I see sometimes that candidates for the office of councillor make great professions. They are all for economy, and are opposed to all plans that would involve expense.

15,744. You think that if any beneficial legislation is to be carried out to prevent pollution of rivers it will not do for the Government to hand over the whole machinery to persons resident in the district, and who might be supposed in some instances to be interested in the very pollutions which it was desired to prevent?—I think that any such measure would not produce a good effect at all, and would not realize what you are aiming at, if the execution of it was left to the local authorities, and there are two reasons why; first, the object of the local authorities would be to keep down the rates, and then individual members of boards are often interested in having outlets to the stream.

15,745 Have you adopted here the machinery of the Highways Act?—No, we have not.

15,746. I believe that has been very generally resisted throughout Yorkshire?—Yes, there has been much disinclination shown to it, but I think that is wearing out. I think that the Highways Act will be adopted eventually.

15,747. A permissive Act of that kind, however good it may be, sometimes takes a long time before it can be brought thoroughly into use?—Yes, before prejudices are worn away.

15,748. Is there not sometimes another reason that certain individual interests are necessarily affected?—Yes, people are always opposed to any change.

15,749. There are some persons who hold office, and although they can tell you with a clear conscience that there is no pecuniary advantage connected with it, yet they are very loth to give it up?—Yes, some of them are very much disinclined to give up office; not perhaps with reference to any pecuniary advantage, but because of the power and the influence attached to it.

The witness withdrew.

Mr. J. Turpin.

Mr. James Turpin examined.

15,750. (*Chairman.*) Are you manager of the waterworks?—Yes.

15,751. To whom do they belong?—To the commissioners.

15,752. How long have they been established?—I have been here for 13 years, and they were established some time before that; I do not know how long.

15,753. How much water do you supply each day to the town?—About 15,000 gallons from the works where we pump the water.

15,754. How do you pump it?—With a steam-engine.

15,755. What power is it?—Six-horse.

15,756. How many houses do you supply with water?—I cannot tell.

15,757. Do you receive rent for the water supplied?—The commissioners do.

15,758. You have nothing to do with that, but only with the pumping?—Yes.

15,759. How many hours a day do you work the pump?—About 10 hours, sometimes 10 and a half; it is not always alike, it depends upon the volume wanted.

15,760. Have you as much water as you want?—Yes.

15,761. Is it good water?—I think so.

15,762. Is it constantly on in the town?—No; sometimes in the night it is off; it is off at present.

15,763. Is the water lifted up to a tank?—Yes.

15,764. What is the tank made of?—Iron.

15,765. Where does it stand?—Upon a building.

15,766. Of what size is it?—18 feet by 16, I believe.

15,767. Who was the engineer?—Mr. Hartley.

15,768. Are there fire-plugs in the town, and have you charge of them?—Yes.

15,769. How many of them?—About 20.

15,770. Have you ever used them to extinguish fires?—Yes.

15,771. Will the water rise to any height from the mains?—Yes, in some parts it will, in others not very far.

15,772. How high will it rise with the best pressure?—I think 14 yards, perhaps more.

15,773. Of what size are the street mains?—The largest of them is 5 inches in diameter.

15,774. Have any of them been choked up by deposits?—No.

15,775. How long have they been laid down?—Since the works were erected, it may be 14 years.

15,776. Of what are the service pipes made that go into the houses, of lead or wrought-iron?—Some are lead and some are iron.

15,767. Do you put them in, or is a plumber employed?—A plumber does the work.

15,778. Do parties apply to the waterworks office before the supply is put on?—They have to apply to the person who collects the rates.

15,779. Does your water come from springs, from a well, or from a stream, or from all three?—It comes out of a well, but there are springs which flow into this well from several streams.

15,780. Has the advisability of making the works larger been discussed?—I have nothing to do with that.

15,781. Of what diameter is your pump?—We have two pumps, and they are each of them 6 inches and 3-16ths in diameter.

15,782. What stroke?—18 inches.

15,783. What number of strokes in a minute?—About 28.

15,784. Do they work well?—Yes, they work very well.

15,785. Have they never broken down?—No.

15,786. Have you more than one engine?—No.

15,787. How often is it necessary to clean out the boiler?—Once a month.

15,788. Do you find much deposit in it?—There is a little crust.

15,789. Do you ever blow out while you are working?—No.

15,790. Have you a mud-cock at the bottom of the boiler?—No.

15,791. Do you make smoke in firing?—Yes; we have no smoke burner.

15,792. Cannot you fire without making smoke?—Not very well at present as we are situated, I think.

15,793. Of what length is your boiler?—12 feet.

15,794. What is its diameter?—4 feet.

15,795. Has it internal flues?—No, they are under the bottom and round the sides.

15,796. What length is your furnace?—About 4 feet.

15,797. Have you a single set of fire-bars or a double set?—A single set, the whole length.

15,798. What length of dead plate is there inside the door?—10 inches or a foot.

15,799. If you fired on that dead plate you could get a fire up without making any smoke?—I think I could not; there is steam as well.

15,800. Did you ever try?—No.

15,801. (*Professor Way.*) I think you stated that you pumped 15,000 gallons a day?—50,000 gallons.

15,802. Could you get more if you wanted it?—Yes.

15,803. (*Chairman.*) By working the engine longer?—Yes.

15,804. You do not pump the water all away?—Not quite at present.

15,805. Did you ever pump for the whole 24 hours?—No.

15,806. If your pump broke down what should you do?—We should get it mended as soon as we could.

15,807. What would the people in the town do for water?—There would be no water, and they must go without it for a time.

15,808. (*Mr. Harrison.*) How were you off for water in 1864 and 1865?—It was scarce then.

15,809. What volume daily could you then supply to the town?—Between 30,000 and 40,000 gallons.

15,810. Instead of 50,000?—Yes.

15,811. Could you continue that through the whole season?—Yes.

15,812. (*Chairman.*) Of what depth is your well?—13 yards.

15,813. To what depth are your pumps placed down the well; where is the working barrel?—It is about eight yards from the top.

15,814. What length is the suction pipe?—About 12 or 13 feet.

15,815. Have you a lift below your rams?—No.

15,816. What is the height of the lift?—About 16 yards above the surface.

15,817. What height has the water to be raised into the tank?—16 yards.

15,818. Do you know what the lift is altogether?—From the bore of the suction pipe it will be near 30 yards.

15,819. How often do you find it necessary to change your bottom clacks?—Sometimes it will go past a year and sometimes not half a one.

15,820. Have you any difficulty in getting to them; how do you draw them?—I only have to loose the door and take the nut out and put a new one on.

15,821. What is the kind of rock that your well is sunk in?—Limestone.

15,822. (*Professor Way.*) What kind of water is that which you supply for washing purposes?—Very hard.

15,823. Does it produce much curd?—I daresay it does. We never use it for washing.

15,824. Do they not use it for washing in the town?—I do not know.

15,825. What is the water pumped into the town for?—They use soft water, I should think, when they can get it.

15,826. Do you make tea with it?—Yes.

The witness withdrew.

PONTEFRACT.

Mr. J. Turpin.

30 Nov. 1866.

Mr. William Gundill (Pontefract) examined.

Mr. W. Gundill.

15,827. (*Chairman.*) Are you manager of the gas-works in this town?—Yes.

15,828. How long have they been established?—I think about 32 years.

15,829. What quantity of gas do you make now in a year?—I think about 10,500,000 cubic feet.

15,830. Is that a greater quantity than you formerly made?—Yes.

15,831. What quantity of coal do you consume annually?—About 1,200 tons.

15,832. For gas making and all your purposes?—Yes.

15,833. Do you use iron or earthenware retorts?—They are all brick retorts but two sets.

15,834. How many have you in use?—Seven brick retorts.

15,835. How many iron ones have you in use?—Two sets of three.

15,836. Then you have 13 altogether?—Yes. The brick retort is 7 feet long and about 4 feet wide.

15,837. What is the price of coal here for making gas?—It averages about 10*s.* 6*d.* a ton; it comes from the Barnsley district.

15,838. What is the price of gas?—4*s.* 7*d.* per 1,000 cubic feet.

15,839. Is that the highest price?—Yes.

15,840. What becomes of the gas tar and the ammoniacal liquor?—The ammoniacal liquor is sold to the proprietor of some chemical works, and the gas tar is sold for asphalting.

15,841. Do you find any difficulty in getting rid of it?—No.

15,842. Have you any coke to dispose of?—Yes.

15,843. How much per ton do you get for it?—9*s.* a ton.

15,844. How much coke do you get out of a ton of coal?—I think better than half a ton of coke.

15,845. Do you ever change the water in your tanks?—No, and we have not done so for many years now.

15,846. What do you purify the gas with?—With lime.

15,847. Have you ever tried oxide of iron?—No.

15,848. Do you purify with dry lime?—It is just moistened a little.

15,849. How much lime do you use in a week?—I cannot answer that question.

15,850. Not quite a ton a week?—No.

15,851. Have you any difficulty in getting rid of it?—No; we sell it at 1*s.* 6*d.* a ton.

15,852. Do the farmers take it?—Yes.

15,853. Are applications made to you sometimes by mothers for permission to take their children into the purifying house when suffering from whooping cough and croup?—Yes, very often.

15,854. Do you make any charge for it?—No.

15,855. Does anything pass out of your gasworks as refuse which causes annoyance to anybody?—I have not seen anything of the sort.

15,856. You do not discharge any foul water, gas tar, or ammoniacal liquor?—No, it is all sold.

15,857. Do you make smoke?—We make smoke sometimes.

15,858. But not much?—No, we principally use coke.

15,859. Do you sometimes use coal?—No, it is too dear; we get a better heat out of coke.

15,860. I suppose the smoke is principally caused when you are charging the retorts?—Yes, but it is not so very much.

15,861. Do you use much water for the purpose of slacking the coke?—Yes.

15,862. Where do you get it?—We have a well of our own in the garden.

15,863. Do you use that well water for any other purpose?—No, only for the ashpans underneath.

15,864. Do you use it for tea making in your own house?—No.

15,865. Where do you get your water for tea making?—We fetch it from the town tap.

15,866. Do you use that water for washing?—No.

15,867. What water do you use for washing?—We collect soft water from the roofs of houses for that purpose; the other is too hard for washing.

15,868. Is that generally done throughout the town?—Yes, I believe so. When the other is used it curdles up, it is too hard.

15,869. (*Professor Way.*) What do you get a ton for the gas tar?—About 1*l.* 1*s.*

15,870. And how much for the ammoniacal liquor?—5*s.*

The witness withdrew.

PONTEFRACT.

Mr. B. Hartley.

30 Nov. 1866.

Mr. Bernard Hartley (Pontefract) examined.

15,871. (*Chairman.*) Are you residing near Pontefract?—Yes, in Tanshelf, the adjoining township.

15,872. Are you the nephew of Mr. Jesse Hartley, of Liverpool?—Yes.

15,873. Are you bridge-master for this riding?—Yes.

15,874. You hold your father's appointment?—I do.

15,875. Did you, sometime since, design a system of sewers for the commissioners of Pontefract?—In 1854 I designed the main sewer on the south side of the town. I was applied to only for that sewer.

15,876. What had been adopted previously to that sewer?—Open drains running down the valley.

15,877. Then that sewer was designed to collect the refuse and take it away to some point further out of the town?—It intercepted the drains running south the whole length of the town.

15,878. And it carried the sewage to an outlet?—It carried it to a point on the road to Knottingley, where it joins a brook which comes from the north of the town.

15,879. Were there depositing tanks built there?—Yes.

15,880. Was it proposed to use the sewage from those depositing tanks on the land?—Yes.

15,881. Do you know whether that has been carried out?—I believe not; it was found not worth while to do so.

15,882. What is the sectional diameter of that sewer?—There were two diameters; there were about 600 yards, with an area of 660 inches, and about 1,282 yards, with an area of 1,779 inches. The sewer was egg-shaped, with an invert bottom of 18 inches in diameter.

15,883. I assume that you did not profess to be attempting more than simply an outlet sewer?—Simply an outlet sewer.

15,884. Not a system of sewers for the place?—Not at all.

15,885. Did you put any ventilation into it?—There are man-holes.

15,886. Are they capable of being opened without the road being broken up?—I think not.

15,887. They have not moveable covers?—No.

15,888. It would cost very little to put a moveable cover in before forming the road surface?—Very little.

15,889. And in that case you might have a ventilating grate by the side of the man-hole?—Yes.

15,890. How long have you acted as surveyor to the riding?—About 10 years.

15,891. Is that since your father's death?—Yes.

15,892. I suppose that you were brought up with him previously, when he was living?—I was.

15,893. In fact you have acted either as assistant or as surveyor since you have been in business?—Yes.

15,894. You would consider yourself as having been articled to your father, or brought up with him?—Yes.

15,895. Were you for any portion of your time with your uncle?—Yes, for three or four years.

15,896. At Liverpool?—Yes.

15,897. As Riding surveyor, have you had to take notice of any nuisances caused to rivers and streams by pollutions of any kind?—It forms no part of my duty to take notice of such things.

15,898. Your duty consists in repairing highways and bridges?—Yes, and the road attached to the bridges 100 yards on either side of each bridge.

15,899. Have you any records of the rainfall of the district which have been kept for any length of time by yourself or your father?—Not by myself. I have no such record.

15,900. Have you any record of the height to which floods have reached in former periods?—In certain cases I have records of that kind.

15,901. In your recollection have you had any of your bridges damaged or washed away by floods?—Not by natural floods. The case of the bursting of the reservoir at Sheffield, and the Holmfirth case, are exceptions.

15,902. Those came within your district?—Yes. Until the last flood I have had no bridge washed away; in the last flood I had a wooden bridge washed away, by Sowerby bridge. The last flood was higher than any I have known. The bridge was only built by me five years ago, and it was higher than the then flood water, but the last flood was three feet above it.

15,903. Where is that bridge situated?—Over the Calder, about three miles from Sowerby bridge.

15,904. Was it entirely carried away in the last flood?—Yes, it was slewed round on to the bank and floated off the piers.

15,905. Were the piers taken round?—No.

15,906. What height vertically did that flood rise from the summer level up to its flood level?—About 13 feet I think on this occasion; it was higher than any former flood of which I have had evidence.

15,907. Have you made yourself acquainted with the amount of rainfall in your district so as to gauge that particular flood?—No.

15,908. We were sitting at Halifax at the time of that flood, and the evidence given to us was that there fell 4½ inches in 48 hours, namely 2¼ inches each 24 hours. Have you noticed the character of the streams during the time that you have had to do with the bridges, as to whether they are to the eye more polluted than when you first knew them?—They certainly are much more so.

15,909. They are getting darker coloured?—They are much more offensive in every respect.

15,910. Do you consider them offensive to yourself when on them or near them?—Frequently they are; at Swillington bridge, and below Leeds, the stream is very offensive.

15,911. When you have had interviews with the magistrates with respect to your own business have they made remarks about the pollutions?—On one or two occasions I have had my attention called to the outlets of sewers, but I have no legal power to interfere with them.

15,912. Supposing that in any conservancy of the streams jurisdiction to prevent pollution in your district was vested in yourself, and that you had proper means given to you, do you think that it is a duty which you could take upon yourself and carry out?—I could not undertake it, it would be so extensive that no one man in the West Riding could undertake it.

15,913. I am assuming it to be put under the same department and a proper staff to be provided?—I do not think that I could undertake it.

15,914. Are you in private practice?—I am not; I devote my whole time to the Riding.

15,915. It is an extensive Riding?—It is.

15,916. What number of bridges have you under your charge?—325. I have also all the public buildings and asylums.

15,917. Are you at liberty to be consulted if any person wishes to consult you; would you consider yourself at liberty to act as consulting engineer?—That is rather a difficult question. I should not refuse to act simply as consulting engineer; I should not carry out any work.

15,918. Have you any restriction put upon you by your appointment?—I have as to carrying out any other work. I should not undertake that.

15,919. At what points of your district are the rivers, in your estimation, most polluted?—I think that the Aire is the most polluted of all the streams, beginning perhaps at Kirkstall, and going down to its outlet.

15,920. I suppose that you have jurisdiction over the tributaries running down to the main streams?—I have bridges over the tributaries.

15,921. Have you many fords in the Riding?—Yes, a great many.

15,922. Where there are no bridges at all?—Yes.

15,923. During flood periods is difficulty expe-

rienced in crossing at those points?—I presume so; I have nothing to do with the fords.

15,924. You do not take charge of the stepping stones, or of the temporary means of getting across?—No.

15,925. Nor of the approaches?—No.

15,926. Have the magistrates authority to put bridges wherever they think proper; could they bridge over those fords?—I think that that is more a question for the solicitor of the riding than for myself.

15,927. Since your appointment have you built any new bridges where there were no bridges before?—I have not.

15,928. (*Mr. Harrison.*) Do you know the part of the river Aire above Keighley, where the improvements have been carried out by the commissioners?—I do.

15,929. Have you observed the effect of the improvements?—I have.

15,930. Should you consider that they have been beneficial, or otherwise?—They have been very beneficial I think.

5,931. What has been the effect on the bed of the river where any of your country bridges cross the river?—At Stockbridge, which is just below Keighley, the effect has been to lower the surface of the stream considerably. I should imagine that the bed is not interfered with.

15,932. I assume that as county surveyor your attention is drawn to the condition of the bed of the river where your bridges are?—Yes, in the neighbourhood of the bridges.

15,933. Have you observed whether in any places the bed of the river has been raised?—In many places it has been raised very much.

15,934. Is not that liable to cause extra flooding of the river and to endanger your bridges?—No doubt to an extent it does endanger the bridges, and causes back water in time of floods.

15,935. Have you, as county surveyor, or have the magistrates any power to prevent that accumulation, or to take steps for remedying it?—I exercise a supervision over the stream for 50 yards on either side of any bridge, beyond that I have no control.

15,936. In cases where you have observed that the bed of the river has risen adjoining a bridge, to the danger of the bridge, have you taken any steps to have the bed of the river deepened?—In the case of some small bridges I have had to have the whole watercourse frequently cleared out, but, as a rule, I have no power beyond 50 yards on either side of the bridge.

15,937. You have power to deepen the bed yourself, but you have no power to call upon anyone else to do it?—Just so.

15,938. (*Chairman.*) If a turnpike road crosses one of your bridges, do you maintain it 50 yards on each side?—As a rule I maintain 100 yards on each side of any bridge.

15,939. And the bridge itself?—Yes, and the structure of the bridge.

15,940. You do not pass that duty into any other hands?—No.

15,941. It may be a turnpike road?—It may be.

15,942. But you do not let the turnpike road trustees have authority over the surface?—No; I repair in each case. There are many exceptions to the rule of 100 yards; many of the bridges are supposed to end with the end of the battlement; that is from custom, from long usage.

15,943. Have you jurisdiction over any of the bridges in Leeds?—Over the Leeds bridge.

15,944. Where the flats were sunk the other day?—Yes, that bridge is under my charge.

15,945. Did the flood injure the battlement of that bridge?—I am not aware of it; I was there on the day of the flood; I have not been there since.

15,946. Are you aware that the battlement is leaning on the up side of the bridge?—It is slightly; but I do not think that that was caused by the flood.

15,947. Is it under your charge that those old flats have been removed?—No, I think that it is under the Aire and Calder Navigation Company.

15,948. But if that bridge had been swept down I assume that the county would have had to rebuild it?—No doubt.

15,949. When wharf walls, or quay walls of any sort, or graving docks, or yards are put up upon the banks of the river, have plans to be deposited with the magistrates, and do they come before you?—Only in cases where such constructions come within the limit of the jurisdiction which I exercise over the stream, viz., 50 yards. I only see that they do not narrow the stream above or below the bridge.

15,950. Do you know the tributary becks which come down through Leeds into the main river?—No. I have no bridges over them.

15,951. They are not under your charge?—They are not.

15,952. Then you have not seen that there are many archways and some buildings put over those streams?—I know that there are such things.

15,953. And that during the last flood the water was over them, in some cases 4 feet, and in some cases 6 feet?—I have no doubt of it.

15,954. They must be very great obstructions to the down coming of the water?—Yes.

15,955. If any person in Leeds, or anywhere upon the river, wishes to build a wharf wall for commercial purposes must he necessarily consult the magistrates, and would the plans come before you?—Not necessarily; I can only interfere in case I find that he is contracting the width of the stream above or below the bridge.

15,956. The jurisdiction of the Aire and Calder Navigation Company is exercised under their own local Acts independently of the magistrates?—Yes.

15,957. And their dredging operations are carried on independently?—Quite so.

15,958. You know and necessarily come into contact with Mr. Bartholomew, the engineer to the Aire and Calder Navigation?—Very rarely. The only occasion on which I have to speak to him is to get him to draw the water off at some of the bridges when I have to repair them.

15,959. Do you superintend any dredging as county surveyor?—No.

15,960. Only the refuse in the smaller streams if they are choked up near a bridge?—Yes, that is all.

15,961. Do you think that the beds of the tributary streams are being raised above their former level by any action which is going on?—I have no doubt that in many cases they are by ashes and refuse thrown in.

15,962. The last flood has done more damage to property bordering on the river than any flood which you recollect?—Yes, much more damage.

15,963. I suppose that one reason would be because there is very much more property to be damaged?—That no doubt would be one reason; the flood also has been much more extensive.

15,964. Are you aware that there is a flood-mark in Leeds, not very far from the Leeds bridge, which is either two or three feet higher than the last flood, and that that flood occurred in 1773?—I was not aware of that.

15,965. When we began taking evidence for the first week or two every witness declared that the floods were less now than they had been formerly, and that land drainage had done it all, and that we should never see such floods as we had had in former times?—I should think that the effect of drainage was the contrary.

15,966. (*Mr. Harrison.*) Have you any county bridges below Ferry bridge?—No, Ferry bridge is the lowest.

15,967. Then you do not know the effect of the flood in the lower part of the Aire?—I do not.

The witness withdrew.

PONTEFRACT.

Mr. R. Heptinstall.

30 Nov. 1866.

Mr. Richard Heptinstall (Castleford) examined.

15,968. (*Chairman.*) Where do you reside?—My residence is in Allerton-Bywater; it is on the north bank of the rivers Aire and Calder, just below their confluence; they join about a quarter of a mile above my residence.

15,969. What business do you carry on?—I am a corn miller and a maltster.

15,970. Where are your mills situated?—In the parish of Castleford, on the south bank of the river, near the dam.

15,971. Do you use water or steam power, or both?—Both.

15,972. What amount of water power do you use?—About 30-horse power.

15,973. And what amount of steam power?—About 10-horse power.

15,974. What weight of coal do you burn per annum?—We do not use steam power regularly, only occasionally; we attach it to one of the waterwheels when we have high water or slack water. When we use it we consume about 16 or 18 cwt. of coals per day.

15,975. What do you do with your ashes?—We put them on the roads.

15,976. You do not put them into the river?—Not any.

15,977. Are your mills situated within the town of Castleford?—Yes.

15,978. Is there a local board in Castleford?—Yes.

15,979. What is the population of Castleford?—I should think about 6,000.

15,980. What is its rateable value?—I do not know exactly; I should think about 8,000*l.*

15,981. Are you chairman of the local board?—Yes.

15,982. How long have you been chairman?—About four years.

15,983. When did you adopt the Local Government Act?—In 1849 or 1850.

15,984. You adopted the Public Health Act?—Yes, and after that we adopted the Local Government Act.

15,985. Have you carried out any system of sewerage?—Yes.

15,986. Where do your sewers empty themselves?—Into the rivers Aire and Calder.

15,987. Have there been any complaints from any persons as to your emptying the sewers there?—I think not, at least very little.

15,988. Are there many waterclosets in the town?—Not many.

15,989. Are the houses generally drained and connected with the sewers?—Yes.

15,990. Have you many private slaughter-houses in the town?—Yes, a good many. We have no public slaughter-houses.

15,991. Do they drain into the sewers?—Yes.

15,992. Of what age is your water-wheel; how long has it been situated where it is?—I do not know. I should say a very long time.

15,993. Have you only one wheel?—We have two wheels.

15,994. Are they undershot or breast wheels, or overshot?—They are both undershot.

15,995. Of what diameter are they?—One is about 20 feet and the other about 17 or 18 feet.

15,996. There is a weir in the river opposite the place where your mill is?—Yes.

15,997. Is your power as good now as when you first knew it?—No, the deals have been lowered about 13 or 14 inches by the Aire and Calder Navigation Company, and consequently the head has been lessened.

15,998. Do they dredge the river below you?—Yes, at a considerable distance below us, but they dredge a great deal above us.

15,999. Is your tail water as free to run away now as when you first knew it?—I think not quite.

16,000. How long have you been acquainted with the river at that point and at that mill?—I am about 47 years of age, and I was born at Castleford. I was away from Castleford from 1840 to 1850.

16,001. Did the last flood do you any injury?—It did us a good deal of damage.

16,002. In what way?—It did us damage in flour and bran, bean meal, and wheat.

16,003. If you had had these extra deal boards on the dam would not the damage have been greater?—They always knock down those boards when the water get to a certain height, so that they would not have made any difference. They used to be nearly three feet, and now they have cut them down to nearly 12 inches. These boards only apply to dry weather seasons.

16,004. Have you noticed whether your dry weather flow is more or less than it used to be; are you shorter of water now than you were in former times?—The years 1864 and 1865 were the driest seasons that I ever knew. I never recollect being so short of water as during those seasons.

16,005. Has the last flood been as heavy as any which you remember?—It has been about two feet higher than any flood which I ever remember before.

16,006. Was it as high as any flood that you have any record of; does any person remember a higher flood?—I think that no person in our neighbourhood recollects so high a flood as the last one.

16,007. How long did it last?—The extreme flood was for about an hour on Saturday the 17th of November, from 11 o'clock in the forenoon to 12. That was the highest point.

16,008. Looking at that flood, and seeing the effects of it, I suppose you would say that whatever the opinions may have been with regard to the diminution of floods the last flood is an answer showing that they have not diminshed?—Exactly so. I certainly had formed the opinion that we should not have such high floods again as we had had, because we have not had them for several years, and the reason why we had a good deal of flour and grain damaged by the last flood was because we fancied it safe, as the place where it was had been out of the way of the highest previous flood, but this flood got up nearly two feet higher, and did us damage.

16,009. How is the condition of the water of the river now as compared with what you once knew it?—Formerly we lived in the township of Castleford, and near to the south bank of the river, and we used the water regularly for general purposes, and we considered it very good indeed up to 1850. Then we removed to the north bank of the river.

16,010. What were the general purposes for which you used it?—For making tea, and washing and brewing, and all sorts of things.

16,011. For your domestic purposes?—Yes, we had no other water at the place where we resided.

16,012. What is its condition now?—It has been very impure lately.

16,013. Is it offensive upon your mill wheel?—In 1864 the water was exceedingly offensive. I myself had diarrhœa very badly, and was laid up for some time. My wife and family also had it, and the millers in my employment were laid up with low fever and diarrhœa. One man was laid up for 10 weeks, and I had only a sufficient number of men to work one part of the mill for two or three weeks.

16,014. And you think that that was partly attributable to the impure state of the water and the effluvium arising from it?—Yes.

16,015. Has it any injurious effect upon the flour?—I do not know; I cannot say that it has.

16,016. How many horse-power do you consider that your water-wheels are?—About 30.

16,017. What does it take to drive a pair of stones?—It depends upon the quantity which you grind; as a rule we grind about three bushels an hour, and it takes three-horse power for one pair of stones.

16,018. And then you have dressing and cleaning machines?—Yes.

16,019. What does it take to drive those?—I should think that it would take two or three horse power

for each dressing apparatus in each mill. We have two mills, and all the machinery for each mill is separate.

16,020. Then you calculate that you have 30-horse water power?—About 30-horse.

16,021. Is the mill your own, or do you rent it?—It belongs to the Aire and Calder Navigation Company; I rent it.

16,022. What do you value a one-horse power at? What is its nominal value, irrespective of local conditions?—I am sure that I do not know exactly.

16,023. It is mixed up with other things?—Yes.

16,024. Would you prefer water power or steam power?—It depends very much; steam power is more certain, and water power is generally a little cheaper.

16,025. Did the last flood stop your wheel?—Yes; we were in backwater on the Friday morning, and we did not start one of our mills until Thursday noon in the next week. The other we started on Wednesday morning.

16,026. Did the flood do any injury to your machinery?—I think not, except that it warped the pit-wheel nearly up to the axle, and we had to take the warp out with buckets, and throw it into the river again.

16,027. Have your buckets iron shrouding?—No, they are wood. One of the wheels is shielded, that is to say, it has iron at the side, but the other is open at the side.

16,028. And there are simply flat boards projecting from the circumference of the wheel?—No, they are not exactly flat; each board bends a little.

16,029. How long have the wheels been down?—The water-wheels were before my day. They have been improved a good deal. Two or three years ago we put shields to one of them and new boards, which we considered improved it very much. One of the wheels is of new construction, and the bend at the bottom lifts out of the water rather easier.

16,030. Are you at all plagued by solid matter flowing down in the surface of the river and blocking the gratings?—Yes, and sometimes we are obliged to stop in order to get it out.

16,031. Are you at all troubled by the carcases of animals coming down?—Yes.

16,032. What are those carcases?—Dogs and cats, and almost all sorts of things.

16,033. Do you take them out of the water or sludge them past?—We send them over the weir or dam and let them go to some one else.

16,034. You do not take them out to bury them?—No, we have no ground to bury them in.

16,035. Do you get much of that class of refuse?—Yes, a good deal.

16,036. It is a nuisance to you?—Yes.

16,037. In hot weather those carcases are very foul?—Yes.

16,038. And they stink very bad?—Yes.

16,039. Would you be sorry if it was the duty of some person to take out those carcases and bury them before they came to you?—I think that that would be a very great improvement, and I should be very glad if it was done.

16,040. Have you much solid pollution coming down upon you in the shape of ashes, or have you had much formerly?—It is not ashes exactly which comes upon us; it is more of a warpy sort of substance.

16,041. Have you any written remarks which you would wish to offer to the Commission?—The water in the river was very clear and good excepting in flood times. That was the case 20 or 30 years ago, and we used nothing else for drinking purposes until about 1850. Up to that time there was a good quantity of fish in the river. I have frequently caught fish myself.

16,042. What fish?—Chub, roach, dace, and gudgeons, and such like.

16,043. And eels?—I never caught any eels, but I have known my brother catch a good many eels there. He had a leap.

16,044. Had you any salmon?—Yes, I generally saw salmon leap up at the dam in October and November up to 1850, and I have never seen them since.

16,045. Have you had the Salmon Fishery Commissioners here?—No.

16,046. Will you proceed with your statement?—Down below the dam it is very shallow water, and it used to be a noted place for fly-fishing, and I have seen large quantities of fish near to the bridge. You could see them from the bridge. Since that time the water has gradually become more impure, the flood waters have been darker in colour, and the sediment left on the bank has been more in quantity and the stench more offensive. In 1865, during the summer, in looking at the water you could see that it boiled up. A lump of stuff came up and relieved the water, and away it went down the river. The stench was so bad that when the wind came from a certain quarter a passer-by would almost be made to vomit. I carried a little camphor in my pocket, and generally applied it to my nose. During that time we burnt a little pitch when the stench came from the river into the mill. In 1865 the part of the water-wheel which runs into the river got coated with a white substance, almost as if you had painted it over, and when you touched it it was quite soapy and greasy, and it washed off again. That was in September and October 1865.

16,047. Then you have come to the conclusion that the river is worse than it was when you first knew it as regards quality of water?—There is no comparison.

16,048. Do you think that its condition will grow better or worse as things go on?—I am afraid that it will grow worse.

16,049. Except something is done to prevent it?—Yes. It used to be a very nice walk to walk along the towing-path at Castleford, but in the last two or three summers it has been almost impassable. There has been a church lately built where I live, and I sometimes go to church in the evening, and I walk along the river bank, and I know that in summer my wife and family were obliged to go into the field and to keep a good way off, as the stench from the river was so bad.

16,050. Have your men complained to you about the state of the water in dry weather?—Very often.

16,051. And you say that they have been seriously unwell?—They have.

16,052. And you think that it was in consequence of emanations from the water at those periods?—I think that it was. It appeared to me that the men who worked on the lower part of the floor were affected with it, but not those who worked on the upper parts.

16,053. Do you work night and day?—We generally work a day and a half, namely, from 6 in the morning till 11 at night; occasionally we should work all night.

16,054. Is there any difficulty in driving your machinery? Does it like a little idleness the same as human beings?—No doubt millstones grind a good deal better when they have stood two or three hours during the night; they go on cooler in the morning.

16,055. Have you recently introduced any improvements in grinding to cool your stones or to carry air in?—Yes, we have what they call an exhaust, which makes the stones grind cooler, and then it is much pleasanter to work and to be in the mill. Scarcely any dust comes down on the under floor.

16,056. Do you use French burrs?—Yes, for grinding wheat.

16,057. What kind of stones have you?—What we call millstone, grit stones.

16,058. (*Mr. Harrison.*) You are chairman of the local board?—Yes.

16,059. I presume that the sewer from the town discharges below your mill?—One part of it. Castleford rises westward; the water on the east side runs into the river considerably above the dam, nearly at the outside of the boundary, but the water on the other side runs below the dam.

PONTEFRACT.

Mr. R. Heptinstall.

30 Nov. 1866.

16,060. How far does it discharge into the river above your mill?—Perhaps 400 or 500 yards.

16,061. Is the black substance which you mentioned as rising to the surface above the mill or below it?—It is above the mill.

16,062. Then that may be the sediment from the sewage of Castleford, and not from that of Pontefract, or Leeds, or other towns?—Only a very small portion of Castleford sewage enters the river above the dam, the principal part enters below the dam, and therefore I should say that the pollution must come from elsewhere.

16,063. What is the water supply to Castleford?—Private wells; formerly they used the river water, but they do not use much now.

16,064. You have not a regular water supply to the town?—No.

16,065. Is the water well supplied from that source?—I think not; you have only to sink a few yards to get water. By the regulations of the local board there is, I think, a convenience to about every four houses.

16,065*a*. Is the water contaminated?—I have heard the medical men complain that it is contaminated.

16,066. Do the medical men attribute ill health to that cause?—Yes, in some cases.

16,067. Have the local board taken steps to prevent that?—They have taken steps to give a water supply at Castleford. A gentleman is present who will speak to that.

16,068. In what direction is that water supply to be obtained?—I drew their attention to a part of the old river which was cut off by the Aire and Calder Company, which is in the township of Methley; it is a lake of 13 acres, but they found that by filtration they could not take out the taste, nor make it so good in colour as it ought to be.

16,069. That water comes from the Calder itself?—Yes.

16,070. Failing that source of water supply, in what direction have you to turn?—Up to Glass-Houghton, a township in the parish of Castleford, where there have formerly been some coal mines, and a quantity of water now runs out into Castleford. We have had the water analysed, and found it exceedingly hard and scarcely fit for domestic purposes, although it is very bright to look at. It has been analysed by an eminent chemist in Liverpool; Dr. Simpson has had it analysed, he being our local officer. I believe that the Liverpool chemist thinks it more fit for medical purposes than for domestic purposes.

16,071. If the Aire and Calder were in a proper condition, and not polluted as they are, the town of Castleford would in all probability have recourse to them for their water supply?—No doubt they would.

16,072. That water is the softest which can be procured, and from your experience as chairman of the local board there is no soft water to be obtained in a neighbourhood like that?—I believe not.

16,073. Are there many waterclosets in Castleford?—I think not many.

16,074. Almost all the conveniences are privies and ashpits?—Yes.

16,075. Have you had ill health attributed to the privies and ashpits at all, apart from the mischief they do to wells?—I have sometimes had my attention called to them by the medical man; he has attributed ill health to the privies.

16,076. Has your local board taken any steps to have them removed?—No, except when they are near the water supply.

16,077. Do you take any steps to have them cleaned out?—Yes; we have an inspector of nuisances, who pays particular attention to them, and I think that he generally takes care that they are in a proper state.

16,078. The local board does not remove the contents?—No.

16,079. Are the contents generally taken out into the country and applied to agricultural purposes?—Yes.

16,080. The boards which you state to be upon the dam are removed or altered as the Aire and Calder Company wish?—Yes; they work in a joint; they consist of a number of long boards about a foot in breadth, and the Aire and Calder Navigation Company turn a crane which pulls out the pipes so as to let the water flow down; they have a certain mark by which their man knows where to draw the deals down.

16,081. It is their own mill, and therefore they have a right to do what they like with the boards?—Yes.

16,082. It is their own mill and their own weir?—Yes.

16,083. In ordinary floods does the water pass over the adjoining banks and flood the land much near your mill?—Not much. I live in rather an awkward place, and this time the water has run over the banks and into the house. During the Saturday I was locked up in the bedroom I noticed the water very particularly; it came right over the fields and the garden and flooded the house, and flooded all the lands on both sides.

16,084. Do you think that much water escapes from the Aire and Calder in that way?—In a flood like this a good deal would go over the banks; the water floods the land on both sides of the river considerably.

16,085. What is the length of the weir across the river?—It is 50 yards long, and I should think about 20 yards in breadth.

16,086. What height does the water rise above it in an ordinary flood?—In the last flood there was very little difference between the level of the water on the top side and the level of the water on the low side of the dam, and as the fall at low water is about seven feet, the water must have risen about eight feet on the top side and 16 feet on the low side; there might have been a foot fall from the top side to the lower side, but I saw them run over it with boats.

16,087. The weir was completely thrown out of operation?—It was.

16,088. How many days in the course of a year are you impeded in consequence of floods?—It depends very much upon the rainfall. Sometimes we are very much impeded and sometimes not so much. I cannot tell how many days we are stopped; it depends upon the seasons; sometimes we have run for nearly the whole winter and have been scarcely at all in backwater, and sometimes we have been in backwater for nearly three weeks together, or perhaps have had a day or two in each week.

16,089. In some cases you have been backwatered with much less flood for a longer period than you were a fortnight ago?—Yes.

16,090. A continuous rain and a continuous flood is more injurious to you, so far as water power goes, than an excessive flood such as happened the other day?—Yes, it passed off in a reasonable time.

16,091. Have you ever considered the advisability of having your water-wheels so that you could raise them in case of a flood, and take advantage of it?—I do not think that it would be practicable; if you raise the wheels you must raise the lower part as well, or the water would go right through.

16,092. In consequence of the character of your water-wheel?—Yes; I do not think that it would be practicable with our wheels.

16,093. What height does an ordinary flood rise over your weir?—About 14 feet is the highest flood which I have known before the last one, and of course it varies up to that.

16,094. (*Professor Way.*) Besides grinding corn you are, I think, a maltster?—Yes, a small maltster; the maltkiln is on the north bank of the river, near my residence.

16,095. You, I suppose, use water for wetting the barley?—Yes.

16,096. Does that liquid run into the river?—Yes.

16,097. Is it offensive in any way?—It does not appear to be offensive when it runs away, and I do not think that it is particularly so.

16,098. Does it smell acid?—I cannot say; I think

that I have smelt it a little acid sometimes in hot weather, but not in cold weather. I only steep about 10 quarters every four days.

16,099. Are there any breweries near you?—Yes, there is one about a mile from us.

16,100. Is that the brewery which was spoken of this morning?—No, it is not far from the bank of the Calder; the other brewery is about five miles from us, on the bank of the Aire, or very near to the river Aire.

16,101. Do you agree with Mr. Hone that the discharge from that brewery makes the river offensive?—I have not been there.

16,102. You do not go past that district?—No.

16,103. What is the case with the brewery near you?—It is very offensive.

16,104. What is the nature of the smell from it?—It is something like the smell of sour ale—ale going bad; the smell is very bad indeed; the liquid runs down into the open sewer, and there is not very much fall, and it stands, and the stench is very bad, it is not quite like the smell from a petty; there is decomposed yeast and such like things, principally barrel washings; at all events the liquid is very offensive in this open sewer.

16,105. (*Chairman.*) Have you thought over the question of how to prevent the pollution of the river in future?—Yes.

16,106. In what form have your thoughts shaped themselves?—My opinion is that the best plan to remedy the evil would be to run the matter into tanks, and to let the water run off again into the river, or to do something to purify it.

16,107. Have you thought at all as to what the future conservancy of the river should be?—I have not.

16,108. Are you inconvenienced in your business by smoke from other premises?—We have a good many glass works in Castleford, and we should be better without smoke; I have frequently named the matter to my neighbours.

16,109. Do they tell you that they cannot burn the smoke?—I have named it to them, and they have said that the principal cause of the smoke was the manner in which the stoker fired, and that if he put on the fire more regularly it would consume a good deal of the smoke.

16,110. Do you know that there is a patent by a gentleman of the name of Semmins, by which the whole of the operations of glass making can be carried on without any smoke?—Is it by gas?

16,111. Yes.—It would improve very much the appearance and health of Castleford if we could have less smoke.

16,112. (*Mr. Harrison.*) Castleford is an improving place, is it not?—Yes.

16,113. It is increasing in population?—It has increased very much indeed since I can remember.

16,114. Between 1851 and 1861 what was the increase?—I do not know exactly; but I think that at the first census which I knew, which was in 1831, we had only 1,000, and now within the district of the Castleford Board of Health we have about 6,000; there is a good deal called Castleford which is not actually in the township of Castleford. The malt-kiln which I occupy is called Castleford; the surveyors of Inland Revenue call it Castleford; it is quite adjoining, but it is not included in the township; it is in another township.

16,115. So that if you took in all those places the increase would appear even larger than you have stated?—It would.

16,116. What is the death rate of Castleford within the limits of your local board?—I think that it is tolerably good; the death rate of last year was about 18 or 19 per 1000.

16,117. Has the health of the people improved of late years, or the contrary?—I think that the health of the people has been better in the last three or four years than it was before; I think that we have had less fever and less diarrhœa.

16,118. When was your local board established?—About 13 or 14 years ago.

16,119. Do you attribute the improvement in the health to the steps which the local board have taken?—Yes; considerable attention has been paid to lodging-houses by the inspector of nuisances and the police.

16,120. Does your experience at Castleford go to show that Castleford, being managed under a local board under which houses are built by regulation, is better off than Pontefract where people build houses just as they like?—I am sure that at Castleford they would not make the houses so healthy if it was not for some restriction. I know that in the adjacent part, namely Whitwood-Mere, they build houses without such conveniences as there are in Castleford, and our officer of health, Dr. Simpson, will tell you that Whitwood-Mere houses are much less healthy than those in Castleford.

The witness withdrew.

Mr. William Newton Wilkinson (Castleford) examined.

16,121. (*Chairman.*) You are agent to the Aire and Calder Navigation Company, resident at Castleford?—Yes, at Allerton-Bywater, adjoining Castleford.

16,122. Are you their business agent?—I am collector.

16,123. How long have you been resident there?—Ten years.

16,124. How long have you known the Aire and Calder rivers?—50 years.

16,125. In what condition are they now as compared with what they were when you first knew them?—They are certainly very much interfered with by sewage compared with what they were when I was a lad. I have been in the service of the company 32 years.

16,126. At what period of the year do you find the rivers, or the streams, the most offensive?—We found the water more particularly offensive in the year 1865, during prolonged dry warm weather.

16,127. Was it the exposure of mud which was offensive, or the water itself?—I am of opinion that the smell arose from the Leeds sewage having been turned into the rivers, and accumulated in large patches previous to a flood. We knew that a flood was coming when we saw what our workmen called "porpoises" coming. These lumps rise to the surface, and a certain amount of gaseous matter escapes from them, and then they sink again; this occurs immediately preceding a flood, and the smell occasioned is very offensive.

16,128. Have any of your men been in any way affected or injured by the bad smell of the water?—I have not known of any who have been directly so.

16,129. Have you heard any of them complain of sickness?—No.

16,130. Are you resident near?—The office and my house are directly at the point of confluence of the two rivers.

16,131. What do your duties consist of as regards the river?—I have no duties except as collector of dues, but I am annoyed by the smell from it.

16,132. Have you ever seen carcases of dead animals floating on the river in dry weather?—Daily and hourly.

16,133. Are they a cause of nuisance?—I have no question of it; I have called the attention of the company's servants repeatedly to it and asked them to remove them further down the river.

16,134. Then would not they become a nuisance to someone else below?—No question of it.

16,135. Would you not imagine that if it was the business of some persons to cleanse the river it would

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be the readiest method to take out those carcases and bury them?—It would be an onerous duty.

16,136. But if it was the duty of persons, and if they were paid for performing it, would it not be much better?—Undoubtedly.

16,137. Did you suffer any inconvenience from the recent flood?—None, excepting the flooding of the cellars of my house about six feet.

16,138. Did it injure any of the property of the company?—Very materially.

16,139. What property did it injure?—Not only the locks but all the property adjoining, I should think to the extent of 2,000*l.* or 3,000*l.*

16,140. Were some of the locks injured?—Yes, in the Upper Calder.

16,141. Were they injured by the accumulation of water or by the solids brought down?—That I cannot state.

16,142. Was it as large a flood as you have ever known since you recollect the river?—I should think that it was about 2 feet 6 inches higher than the flood which occurred about 22 years ago. I was in the service of the company at Wakefield then.

16,143. Have you knowledge of any higher flood than this last one?—None, except the one which was referred to by a previous witness in 1775; that was higher, I should think, by probably 18 inches.

16,144. Has it occurred to you that anything should be done to correct the present foul condition of the rivers if possible?—My humble judgment is that you should prevent the Leeds sewage, and all other sewage, from going into the river.

16,145. That it should not be allowed to go in as at present?—Certainly not.

16,146. Do you know anything of the dredging operations upon the river?—Yes.

16,147. Are they much larger than formerly?—Yes, we have two dredgers now, we had only one 25 years ago.

16,148. Is the tonnage of your boats larger than it was formerly?—It is larger.

16,149. Do you not think that boats of heavier tonnage would require dredging in order to get the river down to a deeper draft?—They would necessarily require it to a greater extent.

16,150. So that the dredging may be to deepen the navigation as well as to keep it clear from refuse brought down?—We profess to keep a navigation of 7 feet.

16,151. What is the deepest draft of boat which you have?—The deepest draft is 7½ feet at best water.

16,152. Then it will puzzle that boat to go along a channel of 7 feet?—Yes, but our navigation from Goole to Leeds, or from Goole to Wakefield, is 7 feet.

16,153. How can a boat of 7 feet 6 inches or 8 feet get along there?—It cannot do it. With reference to dredging, there is no question that the Leeds sewage is the great cause of the frequent necessity.

16,154. The sewage of the town of Leeds?—Yes.

16,155. It is the pollution brought down from Leeds which causes the great injury and the great inconvenience which you suffer?—There is no question of it.

16,156. You mean the floating matter which comes down does the injury?—Yes.

16,157. (*Mr. Harrison.*) Has the late flood formed banks to any great extent in different parts of the river?—It has accumulated a great quantity of mud on the edges of the river.

16,158. Since the flood have the boats experienced any difficulty in passing up and down the Calder?—Yes, the flood has accumulated a great quantity of sand opposite my house. Instead of having a 7 feet navigation I should think that the navigation is now not more than 6 feet. We shall at once have to bring our dredgers to work.

16,159. And your dredgers will have hard work for some little time until you get the depth restored?—Yes.

16,160. (*Chairman.*) You are situated at the junction of the Aire and the Calder?—I am.

16,161. Is there any difference in the water of the two rivers?—A decided difference.

16,162. Which is the better and which is the worse?—The river Aire is like a huge sewer in hot weather; comparatively speaking, the Calder is clear.

16,163. (*Mr. Harrison.*) The volume of water passing down the Calder is larger than that passing down the Aire, is it not?—Yes, just at the mouth it is.

16,164. And the population upon the Calder is probably less than that upon the Aire?—I do not know; I am not prepared to say that.

16,165. Leeds and Bradford are upon the Aire?—Yes; and Halifax, and Dewsbury, and Wakefield are upon the Calder.

16,166. (*Professor Way.*) Why do you attribute the whole of the evil to Leeds?—Because the evil of the Leeds river is more prominent than that of the other.

16,167. Are there not Bradford and several other towns?—Bradford comes into the Leeds river.

16,168. But you say that it is the Leeds sewage?—What we call the Leeds dyke embraces Bradford.

16,169. I understood you to say, and another witness previously said, that the injury had arisen since the Leeds sewage had been turned into the river Aire?—The evil has been brought more prominently before us.

16,170. May not other causes besides the discharge of that sewage have contributed to make the river bad in that case?—Possibly so, but the matter has not been so directly brought before us.

16,171. When you mention the period of the Leeds sewage being discharged as the period at which the nuisance began, the common acceptation of that would be that Leeds was the cause of it?—We never felt the inconvenience until the Leeds sewage was turned into our rivers.

16,172. Is it possible that other towns were at the same time contributing to the pollution of the river Aire?—No question of it; but when Leeds turned all their sewage into it it brought the evil to a climax, and then we felt it.

16,173. But you do not mean to say that the whole injury has been done by Leeds?—Certainly not.

16,174. Has not the river been getting foul from other sources during that time?—No doubt it has, but not to such extent as from the Leeds sewage; the Leeds sewage has been the great cause.

16,175. You know that at the present time Leeds is not half or one fourth sewered?—Possibly not.

16,176. And, therefore, if sewerage was carried out in Leeds to the fullest extent the sewage would be very much more than at present?—Possibly. My opinion is, that if it goes on for the next 10 years at the rate which it has gone on our river will not be navigable at all.

16,177. You seem to ascribe the whole obstruction to sewage. Are you aware that large quantities of solid matter are thrown in from different manufactories along the river?—Then the parties are liable under the Aire and Calder Company's Act.

16,178. Are you aware that there are also large quantities of dye water?—We have no claim upon anybody unless solid matter is thrown in.

16,179. I suppose that putting a stop to the discharge of sewage would not purify these rivers?—It would be the most desirable thing possible. I do not say that it would clear the river altogether and make our salmon came back again, but it would be a very great thing.

16,180. Have you noticed the condition of the streams progressively, irrespective of sewage?—I have not.

16,181. (*Mr. Harrison.*) Your officers could only interfere with the throwing of ashes and other refuse into the river within the limits of their jurisdiction?—Exactly so.

16,182. Bradford is not within your jurisdiction?—It is not.

16,183. And there are a great number of mills at other places in the same case. Keighley is not within your jurisdiction?—Yes.

16,184. (*Professor Way.*) But still you have been giving an opinion in the abstract, apart from your official position, as to the causes of the pollution of the river?—Just so.

16,185. And your opinion is that the river has been brought into its present state by the discharge of sewage?—I do say so.

16,186. Have you taken into account the other sources of pollution which in our opinion are very considerable?—No. I recollect that about nine months ago, when our man was dredging with his machine, I said to him, "It smells badly," and he said "Yes, sir; it is entirely from this Leeds sewage."

16,187. (*Chairman.*) Do you know that Leeds deals with probably more skins than any other place in England, and perhaps than any other place in the world?—Yes.

16,188. That it dresses and tans 3,700,000 skins per annum?—I am ignorant of that.

16,189. Refuse from tanpits and skinneries may have something to do with the pollution?—No doubt of it; but our dredger's pans are filled with a certain material which I need not explain to you gentlemen.

16,190. Waterclosets are carried out to a very small extent in Leeds as compared with the population, or as compared with London and other towns, and if the watercloset system is put into operation you will be ten times worse off than you are now?—Yes.

16,191. Have you thought it necessary that Government should step in to remedy this state of things?—Government or some other authority must step in or we shall cease to be a navigation.

16,192. What other authority should step in; the Aire and Calder Navigation Company have statutory powers to prevent solids being thrown into the river?—Yes, but offenders are so insidious that we cannot catch them.

16,193. (*Mr. Harrison.*) How are you supplied with water in the tongue of land between the Aire and the Calder?—From the hills.

16,194. I mean for your own domestic supply?—My own individual domestic supply is from pumps and from rainwater.

16,195. Is the water from the pumps useful and satisfactory for domestic purposes?—We have no reason to complain of it; it is pretty well filtered.

16,196. Is it a hard water?—Yes.

16,197. What depth is the well?—I am not prepared to say that.

16,198. Does the water in the well come from the river filtered through the rock?—That is my impression.

16,199. And that filtration you find sufficient to give you a pure water?—We have a good water for domestic purposes. For soft water purposes we have water quite different from that.

The witness withdrew.

Mr. Adam Jessop (Castleford) examined. *Mr. A. Jessop.*

16,200. (*Chairman.*) Do you practice as a surgeon in Castleford?—Not at the present time; I have done so.

16,201. How long have you been resident in Castleford?—About 37 years.

16,202. What is the population of Castleford?—About 6,000 at the present time.

16,203. Do you remember the first outbreak of cholera in 1832?—I do.

16,204. Did it prevail to any extent in Castleford?—Yes, to a great extent at that time in comparison with the population.

16,205. In what parts of the district or town did it then prevail?—Mostly in the lower parts of the town near to the water, and in the lower parts of the ill-drained districts.

16,206. In 1832 in what state was the river as compared with what it is now?—The river at that time was in a much better state than it is at the present time.

16,207. Do you remember the outbreak of cholera in 1848-49?—I do.

16,208. Was it more severe or less severe than in 1832?—It was much more severe than it was in 1832.

16,209. Was the state of the river better or worse then?—It would be a little worse than it was in the first outbreak.

16,210. What has been the health of the population since 1849 and 1850?—I think upon the whole pretty good.

16,211. Have any improvements been carried out since that last outbreak of cholera in 1849 to account for the better state of health?—Yes, drainage more especially.

16,212. Is there any public water supply?—No, nor even is there much private water supply at the present time.

16,213. Then where do the poorer population get their water?—Mostly from the river at the present time; there is no other source.

16,214. Do you mean that at this time they obtain water for domestic purposes from the river?—Yes, principally.

16,215. Although it is tainted by sewage?—Yes. A colliery in the neighbourhood has latterly been opened, which has drained our private well.

16,216. There is, I understand, a local board in Castleford?—Yes.

16,217. Do you know whether they have considered it a part of their duty to discuss this question of giving the inhabitants a proper supply of water?—I believe that the matter has been frequently discussed by them, but not yet with any beneficial effects; at all events, they have not yet come to any decision.

16,218. Did you notice the last flood which you have had?—I did.

16,219. Has it left any evil effects upon the population?—It appears to have done considerable damage, to the property near the river more especially.

16,220. Did it flood dwellings of any of the poorer people?—A great number.

16,221. And in flooding them it would of course render them damp?—Yes, and of course they would remain damp for some time.

16,222. And I suppose that, as a medical man, you would say that the injurious effects would not be visible now, but will come out hereafter?—No doubt.

16,223. The human being does not necessarily give way immediately?—Just so.

16,224. But these evil influences may show themselves in after life?—They will no doubt be felt in the course of time.

16,225. (*Mr. Harrison.*) How long is it since you ceased to practice in Castleford?—A little more than 10 years.

16,226. Then you have hardly had an opportunity from experience and practice of observing the improvement in health consequent upon the formation of the local board?—No, not from my own personal knowledge, but I believe that health has improved since then.

16,227. (*Chairman.*) Do you know anything about the sewerage of Castleford?—I do.

16,228. It is sewered?—In some parts.

16,229. Are you a member of the local board?—No.

16,230. Is there anything further which you wish to add?—I would simply say that I think that the health of Castleford might be very materially improved by an efficient water supply, and especially

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by the drains being better ventilated. They are not ventilated at all now. I think that that is a very important matter, and I was very pleased to hear the Chairman make the very firm observations which he made a short time ago as to the ventilation of drains. It is a matter which I have thought of for some time. I may further say that the rainfall on Friday the 16th of November, commencing at about 3 a.m. to half-past 5 p.m. was $3\frac{1}{10}$th inches at Castleford.

16,231. As gauged by yourself?—Yes. We had no rain previous to 3 o'clock, and none after half-past 5 o'clock on Friday. The rain did not continue 24 hours, but simply $14\frac{1}{2}$ hours.

16,232. (*Mr. Harrison.*) We have had information that it rained for 48 hours, but we gather that during those 48 hours no more rain fell than what you mention?—On the Sunday we had a little more rain, but only rather more than the tenth part of an inch.

The witness withdrew.

Mr. R. Heptinstall.

Mr. Richard Heptinstall (Castleford) further examined.

16,233. (*Chairman.*) You have carried out certain sewers in Castleford?—Yes.

16,234. Who designed your sewers?—In the first place we had a person of the name of Peter Sharrock. We employed him as surveyor, and he surveyed the district and made us a plan, and gave us the depths and so on, and the sewerage was laid according to his plan.

16,235. Have you more than one outlet?—We have two outlets.

16,236. Where do they empty themselves?—Into the rivers Aire and Calder.

16,237. Below the junction?—Yes.

16,238. Do you know at what depth the inverts of those sewers are laid as regards the dry weather flow of the river?—The bottom of the lower sewer, which empties itself in below the dam, is not much above the low water level; it is about a foot.

16,239. Then so long as it is dry weather that sewer discharges its contents down into the river?—It does.

16,240. What does it do when the river is in flood? It cannot carry the sewage down when there is a flood.

16,241. Does a flood backwater the sewer?—Yes.

16,242. The sewage flows up?—Yes, no doubt.

16,243. When the river is above the summer level the sewers are necessarily backwatered and flooded?—Although the outlet of the sewer may be covered 2 feet the water still runs out, because the sewer has a considerable fall.

16,244. The flood will backwater it so far as the flood will reach in the sewer?—Yes.

16,245. Are you aware that when sewers are in that condition any solids in the sewers coming down will, immediately upon the sewage coming into dead water, begin to deposit?—I daresay. We have one preventive in the sewer; a sort of well is made where the grates are below the sewer, so that the solid deposit remains in the well, and the water runs off again.

16,246. Of what size is that well?—About 18 inches square.

16,247. You mean the gully?—Yes.

16,248. In the rain which we have heard of that well would be filled with solids in the first five minutes?—Perhaps it might be.

16,249. And after that the solids must go away with the water?—Yes. I have no doubt that a good deal of solid matter would go into the river.

16,250. Are your sewers at all ventilated?—Not at all.

16,251. After what you have heard do you think that you will attempt to ventilate them?—I think that they ought to be ventilated.

16,252. Have you ever heard any complaints of foul smells from the sewers?—Yes, I have frequently smelt them myself, but that is generally in hot weather, and then we apply a little chloride of lime to them, which takes the smell off for a time.

16,253. But there may be plenty of cases which escape your notice where the mischief is going on?—It may be so.

16,254. Is there any protection over the mouth of your sewer to prevent the wind blowing up it?—No.

16,255. If the wind is blowing pretty strong in the direction of the mouth of the sewer, do you think that it is possible that it may blow in and blow the foul gases up into the town?—I think that it might do so.

16,256. Do you think that it might be advisable to cover the mouth of the sewer with a flap?—Yes, a sort of door.

16,257. Carrying that door to the bottom of the sewer within about six inches?—Yes.

16,258. The dry weather sewage would then flow out without inconvenience, and the wind would not be allowed to blow in so as to drive the gases up into the town?—Yes, I think that that would be an improvement.

16,259. I suppose that you have not noticed that at particular periods people complain more of the stink than at other times?—I have not noticed that particularly. I think that it would be an improvement to have a door at the bottom.

16,260. And to ventilate all the higher points?—Yes. We have a new scheme of sewerage which we are discussing; what we call the western portion of Castleford drains into an open drain in the township of Whitwood. In that open sewer the water stands a good deal and is stagnant. We have made an offer to the Whitwood people to construct a new sewer in the lower part of Castleford, and to take it out to the lower part of the town, and to allow them to put all their sewage below the dam instead of above the dam, which would give the Whitwood-Mere people a considerable fall. We promised to take the sewer to a certain point if they would take it forward. That would put their sewage water in at a lower level than they have had hitherto, and we also should put our sewage in below the town. But unfortunately they have no local board, and they have no legal means of getting money to do the work with; it is, however, under consideration with them.

16,261. The new Sanitary Act gives them the machinery and the power to raise the money?—They have applied for permission to come under the Local Government Act, but they have not sufficient population.

16,262. If they petition the Secretary of State a Commissioner will very probably be sent down, and although the population is below the requisite amount, yet, if they are willing to adopt the Act, I can answer for it that no obstruction will be thrown in their way, for the alteration was made to serve this purpose. After the Highway Act was introduced parties adopted the Local Government Act simply for the purpose of checkmating the Highway Act?—Yes; but they are now very anxious to come under the Local Government Act.

16,263. (*Mr. Harrison.*) Has your board considered the propriety of irrigating land with sewage?—No.

16,264. Is there land suitable for the purpose?—Yes, I believe so; there is land in the neighbourhood.

16,265. Upon which the sewage could easily be carried?—I think so; it would have to be raised by artificial means, it cannot run on of itself. There is some land belonging to Lord Houghton on which the sewage might go; it is not in the township of Castleford, it is just beyond the boundary.

16,266. (*Chairman.*) Did you ever see a sewage farm?—No.

16,267. Did you ever see 20 tons of grass cut from an acre at one cutting?—No.

16,268. Did you ever hear of it?—No; that seems an immense quantity from an acre at one cutting.

15,269. Twenty-five tons have been cut and sold at 1*l.* a ton, it having been grown in three weeks; that is

Italian rye grass, and from 50 to 60 tons per annum have been cut from the same land?—It seems an immense quantity. I have no doubt that sewage would be very good for agricultural purposes if properly applied.

15,270. If you begin to grow Italian rye grass you must store the field with it, and, if possible, the most profitable thing to which you can apply it is to give it to milch cows, and to turn it into milk on the same day that it is cut?—Yes, in a green state.

16,271. (*Mr. Harrison.*) When your sewer is waterlogged during a flood is the sewage forced back into any of the cottages?—I think that it may be forced back into some cottages in a low locality.

16,272. Does not it come under your notice as the local board whether such is the case or not?—We know that the sewage does get flooded back into cottages, but we have no remedy at present.

16,273. You have created the nuisance; may not the parties look to you for the remedy?—We want some system of getting rid of the sewage.

16,274. Is it not incumbent upon your local board to take some steps for the purpose, and not to let those cottages be in that condition?—If we allow the sewage to come up the sewer I think that we should take it away, but when a flood comes, and flood and sewage are all in the houses together it is a difficult matter.

16,275. (*Chairman.*) Have you read of the drainage of Holland?—Yes.

16,276. There are enormous areas there many feet below the sea level?—I suppose so.

16,277. And they manage to keep the water out?—Yes.

16,278. With regard to your backwatered sewers, it is quite possible to sewer a place which is below high water and yet never to allow it to be flooded?—Yes, it could be done if we had doors to keep the water from coming up.

16,279. When a flood rose they would prevent the water from getting in, but of course they would prevent the sewage from getting out?—Yes. We have sometimes thought of another plan of cleansing the sewer, that is running the water into the sewer above the dam, and making an outlet for the sewer below the dam. I do not know whether the Aire and Calder Navigation Company would allow this or not; it would be an improvement. The lower part of Castleford is the worst, the upper part is well drained and well sewered, the difficulty is with the lower part.

James Horatio Simpson Esq., M.D., (Pontefract), examined.

16,280. (*Chairman*). You are resident in Pontefract?—Yes.

16,281. How long have you been resident here?—I think about 21 or 22 years.

16,282. Are you acquainted both with Pontefract and with Castleford?—Pretty well. I am acquainted with Castleford as having been its officer of health now for about eight or nine years, I think ever since the local board was formed, with the exception of the first three years.

16,283. What is the condition of the public health at Castleford as compared with Pontefract?—I do not know that I can speak as to the mortality of Pontefract, because I have never made any analysis of the returns, but I should think that Castleford stands in a better condition as far as regards its death rate than Pontefract. I am only speaking now from that which I recollect in the last two or three years. I do not think that the case was the same in the first two or three years of my appointment.

16,284. Pontefract, we understand, has neither surveyor, officer of health, nor anybody but a mayor, and a town clerk, and commissioner?—I do not know that it has had any surveyor, or any officer of health, until the last five or six months; and since the outbreak of cholera I think that one of the medical men was appointed officer of health during the last three or four months. A police constable has always acted as the inspector of nuisances.

16,285. In what state do you consider the present water supply of Castleford to be?—It is very bad.

16,286. Do the people complain of difficulty in obtaining proper water?—They have complained very much to me when I have gone round of the difficulty of obtaining water, and also of the supply of water in the wells diminishing, but I do not know that that was to be attributed to anything so much as the peculiarly dry weather of 1865.

16,287. Do you think that the water has increased in the wells since the last wet season?—Yes, except that the pumping of a coalpit which has been sunk has certainly affected it.

16,288. And if the operations of coal are extended I presume that the effect will be much more serious?—That I cannot tell.

16,289. In what state is the river as it flows past Castleford?—It is as bad as it can be; it is very much fouled by pollution, particularly the pollution of the towns above. Of course Castleford does its best to make it worse, like most other places on the sides of the river; I mean by throwing its own sewage into the river.

16,290. It receives the sewage in the river from above, and it puts in its own sewage to the injury of people below?—Yes.

16,291. Is it the fact that a great number of persons now drink the water of the river?—I do not think that many of them do, unless that has been so since the operation of sinking the coalpit. They do not do so in the town, because their reply to me was that they could not use that water, and that even boiling it did not take out its nasty taste.

16,292. Are there any waterclosets in Castleford?—There are only nine.

16,293. How many privies are there?—A great number; there are 438 privies.

16,294. And what is the population?—Above 6,000.

16,295. What amount of population would be represented if you took a privy to each family?—I do not know. A large number of the houses built in Castleford have been built in the last few years, many of them have been run up as a speculation, and others by private individuals as a matter of letting.

16,296. Have you much excrementitious matter upon the surface?—Not a great deal.

16,297. Where do the people go?—To the privies. The privies are very fairly constructed.

16,298. Do you think that there is sufficient accommodation for the population?—I should say not.

16,299. Then if there is not sufficient accommodation for the population, children and adults must be driven occasionally to the use of the bye-lanes and the streets?—I cannot say that there is much impurity of that sort in the streets. I should think that the poorer population in Castleford are far better supplied with privy accommodation than they are in most towns.

16,300. In the expression "most towns" do you include this in which we are sitting?—As to that I cannot speak. I think that there is about one privy for every three or four houses.

16,301. Then the word "privy" ought to be sponged out, because the word "privy" means privacy, and it cannot be a very privy thing if it has to serve four or five houses. In what condition are those places; have you ever as officer of health had your attention called to them; are they kept clean, or are they dirty?—The bulk of them are kept very clean; in some few cases they are not clean where they are attached to lodging-houses, or where there are old premises which cannot be interfered with by the local board without great trouble. Most of them are constructed in such a form that they will not take above a certain quantity, and I believe that the local board take care that they are very frequently emptied, at least that is what I have urged upon the surveyor.

16,302. You know very well that when that effete

matter is kept for a few weeks it becomes putrid?—Yes.

16,303. And when it has set up putridity it begins to ferment?—Yes.

16,304. And when fermentation sets in there are gases of decomposition given off?—No doubt.

16,305. Do you know whether those gases are injurious to health, or otherwise?—It is the opinion of many medical men that those gases are injurious, but there is perhaps an answer to them, namely, that the men engaged in cleaning out privies and things of that sort do not complain, and very often do not suffer as those who are not so engaged do. I should say that privies are objectionable so far as they are injurious to property, but whether they are injurious to health, unless they are very largely concentrated, I do not like to assert upon my own professional opinion.

16,306. Are you aware that it is a fact that in proportion as middens, cesspools, and cesspits have been removed from the midst of a population, and fermentation has been prevented, the health of the district has been improved?—There I quite agree with you.

16,307. Whether the gases are injurious directly or indirectly?—Yes, I quite agree with you on that point, that it is desirable that they should be removed (as frequently as they can be), and that extreme cleanliness should be used.

16,308. For instance, in the case of a privy attached to a cottage house, we will say that the bedroom window may open over the surface of that privy?—Yes.

16,309. If, as in many instances, the privy is positively projected underneath the sleeping room then any gases of decomposition will ascend into that room?—Then I should say that that privy is decidedly injurious to health, and that such a thing ought not to be allowed if it could possibly be avoided.

16,310. You know, I suppose, the symptoms of typhus fever?—Yes.

16,311. Do you agree with other medical men that that is what is termed the dirt fever, or a fever positively caused by something foul which is removeable?—I think that very likely it is attributable to those circumstances.

16,312. Over-crowding, bad clothing, bad lodging, and bad diet?—I would not say that it is always attributable to those circumstances, but it is very largely so, and if any germ of the fever exists those circumstances would develope it.

16,313. Do you know in what condition our gaols are at present?—No, except that they are free from fever.

16,314. Do you think that typhus fever never occurs in a gaol?—I know that the gaols are free from it.

16,315. And I suppose you know that inmates of gaols are most subject to typhus fever when in their haunts in towns?—Yes, but inmates of gaols are well fed and well clothed, and well looked after as regards water and other necessaries of life.

16,316. Are you aware that until Howard took up the question and examined and reported upon gaols, and pointed public attention towards them, gaols in this country were the very hotbeds of putrid typhus fever?—Yes.

16,317. And that so bad was it at one time that the judge, the counsel, and the jury were all smitten by the pestilence which was brought in by the prisoners who were placed at the bar at the great black assizes?—Yes, I am quite aware of that from reading books about it.

16,318. If typhus fever has been entirely removed from gaols, do you think that it might be removed from a town population?—I think that it might be removed to an enormous extent, far more than it is now; I would not say entirely.

16,319. If you can remove it to an enormous extent, why are you to stop short of entire removal?—That is a question which I cannot answer.

16,320. If you are called into a case of typhus, what kind of place do you generally go into to see it?—Unless the disease has been taken by communication from one person to another, I am generally called into a place where the people are ill fed, ill clothed, over-crowded, and dirty.

16,321. And those medical men who call it dirt fever do not very much misname it?—I do not think that they do.

16,322. Is it true that typhus fever is more fatal between the ages of 20 and 40 than in the cases of younger or older persons?—I should say that it is.

16,323. And that if it seizes an adult he has a very bad chance of recovering from it?—Yes, his chances are worse than those of a younger person.

16,324. Is it liable to leave ill effects behind it, supposing that a man's constitution will pull him through the crisis itself?—Yes, there is no doubt of it.

16,325. If you have cases of typhus fever in a town from foul air and filth which is allowed to accumulate, and if the head of the family is taken away, what becomes of the widow and the children if they are very poor?—In the greater proportion of cases they are thrown upon the township.

16,326. They become paupers?—Yes.

16,327. And if they are once pauperized, is it not most probable that they will remain so?—Yes.

16,328. That the poor woman and her children are put into a hopeless state?—Yes.

16,329. If it could be shown that any house, or any set of houses for a series of years had turned out typhus cases, that the head of the family had died, and that the family had been taken away to the parish to be maintained by the parish, do you think that, as a matter of pounds shillings and pence, it would have been true economy to have prevented that state of things by removing the conditions which caused the typhus?—Most undoubtedly it would.

16,330. Do you think that a parish may have directly and indirectly paid many times over the worth of such a house?—Yes.

16,331. If you have a family pauperized it is very difficult to calculate the money cost of that family to the community?—Most undoubtedly.

16,332. Do you think that local boards usually consider their duties in that light?—I should not like to speak of other local boards except the one which I have had to do with, but there are a great many allowances to be made for local boards. In the first place they have to contend with the prejudices of the town in which they are living; they have to find the pounds shillings and pence which provide for the works, and therefore, however willing they are to attend to the suggestions of their medical officer, of course there are very frequently difficulties independent of that which they cannot get over, such as the high rate of assessment and other things.

16,333. There are such things in government as direct taxation and indirect taxation, are not people generally irritable under direct taxation?—They are no doubt more so than under indirect taxation,

16,334. The rate of the local board levied for local improvements is direct taxation?—Yes.

16,335. But there is another species of direct taxation, the amount of which is accumulated indirectly, namely the poor rate, which a ratepayer must as certainly pay as the sanitary rate?—Yes.

16,336. If he is paying a large poor rate he may not see the causes which bring about that state of things, and he does not grumble at the heavy poor rate excepting as ratepayers grumble at rates of all sorts, but if the board, wishing to improve the sanitary condition of the district, proposes to levy a sixpenny rate he is dreadfully angry with that board, although that rate might save him a shilling poor rate, besides saving an incalculable amount of human misery?—That is just the case.

16,337. Then do not you think that the ratepayer wants to be educated into a true knowledge of the facts

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concerning him?—I am sure that he does, particularly as regards sanitary matters.

16,338. And these pollutions?—Yes.

16,339. My colleague, Mr. Harrison, says that it would be an incalculable advantage, both for the present and for the future, to Castleford if the ratepayers as well as the local board could see what the place would gain from wise and judicious expenditures at the present time?—Yes.

16,340. And that Castleford may suffer from something very much more oppressive than mere money rates; that wisely to expend rates upon preventive works is the truest economy?—There is no doubt about it. There is one thing I should like to mention, viz. the returns as regards fever.

16,341. Have you prepared any returns with regard to fever in Castleford?—I have. I make a report to the local board once in every 12 months, and sometimes oftener, and I have brought with me a copy of my last report made about six months ago.

16,342. Then you are prepared to lay before the Commissioners returns as to fever?—Yes. The death rate of Castleford last year was 16 in 1,000; it has been as high as 22 and 23 in 1,000, but it has gone on gradually declining. There were only 16 adult deaths in the six months from all causes. The improvements of the local board have tended to diminish the pauperism amongst the poor population who were able to work, and the result was that not so many women and children were thrown upon the poor rates in the last three years as in the previous three years.

16,343. If you by any measures of prevention diminish the class of disease which has been termed preventible, namely, typhus, typhoids, and other fevers, and if you reduce the death rate you diminish pauperism, and therefore you diminish the poor rate?—Yes. This report was made on the 3rd May 1866.

The witness delivered in the following report:

"To the Chairman of the Local Board of Health, Castleford.

"Dear Sir,

"I am glad that it is in my power to make a favorable report of the present state of health in Castleford, and those parts of the district under the jurisdiction of the local board, and also of the improvement in the general aspect of the streets, alleys, and yards as regards cleanliness and absence of causes likely to affect the public health.

"The result of my quarterly and more frequent inspections leads me to the conclusion that the inhabitants are more alive than formerly to the necessity of attention to those important matters conducive to health which are under their own immediate control, such as cleanliness about their own yards and houses, the frequent emptying of privies and ashpits, and the avoidance of all stagnant pools of water or other deposit, &c., and to this attention on their part and the strict inspection and activity of the inspector of nuisances, I am disposed to attribute the decrease in the rate of mortality during the past year. This decrease is caused by the absence of those diseases which are called epidemic, such as scarlet fever, and is especially among the younger portion of the inhabitants of the town. It is by them that the baneful influences which affect public health are the soonest felt, and therefore by them the absence is the more readily appreciated. A reference to the mortality of the past year and former years bears me out in these remarks.

"The arrangement of the privies communicating with the open ashpit is not one of the best. I do not see any means of altering this, unless the local board issue a general order by which the open ashpits are covered in or the privies constructed with a moveable trough or box which would be regularly and frequently emptied at short stated intervals by the scavengers, and the refuse taken to some depository where it could be deodorized and converted into manure. Such a plan would of course require a proper system of scavenging, but I have no doubt of its benefit in a health point of view, and I think that it would be commercially successful.

"I have had good-natured complaints made to me respecting the effluvia arising from the slaughter-houses. There is no means of obviating this and the deposit of the offal as at present by the butchers but the plan of erecting public slaughter-houses for the use of the butchers generally.

"I find the death rate in Castleford for the past six months to be a total of 59, as follows: Infants under 2 years, 24; children from 2 years to 10 years, 6; adults under 20 years, 10; from 20 to 50 years, 3; under 80 years, 16.

"There have been no deaths from scarlet fever, few from whooping cough or measles. The deaths among the children are chiefly from convulsions, teething, &c. I wish particularly to point out the fact that there are only 19 deaths from all causes between the ages of 2 years and 50. This, in a population of nearly 6,000, is a low rate of mortality. Among the 19 fever has claimed six victims.

"The sanitary condition of Castleford contrasts favorably with that of Whitwood or Glass Houghton, and it would be satisfactory to ascertain if the decreasing mortality in the adult population of the place during the past two years has had any material influence on the pauper population, i.e., on the number of widows or children who have been thrown on the township, for in this direction the benefit of sanitary improvements ought to tend. The number of deaths from fever in Whitwood during the six months has been nine, and this, in a population of not more than two-thirds that of Castleford, shows the unhealthy character of that district. I would strongly advise the adoption of some measures conjointly by the Castleford Local Board and the ratepayers of Whitwood by which sanitary remedies could be applied to that district. It was at Whitwood where the smallpox first appeared; it is there that scarlet fever and typhus always prevail, and I am afraid that if the summer should be favorable to the spread of epidemic or contagious diseases, it will be there that the first plague spot will show itself to extend to the surrounding district of Castleford.

"It is highly desirable, as a completion to any scheme of sanitary improvement, that a good supply of water should be available. This is not in existence at Castleford. The surface wells in use are liable to be influenced by various causes, and their supply may at any time be greatly lessened or vitiated, and then disease follows as a natural consequence of an impure article of food. I should fail in my duty if I did not direct the attention of the local board to this point.

"I have to report that the lodging-houses, as a general rule, are clean and not over-crowded.

"I am, dear-sir, your obedient servant,
(Signed) "J. H. Simpson, M.D.,
"Pontefract, May 3rd, 1866. Officer of Health."

16,344. Have you the annual death rate for any number of years back?—I have it for several years back.

16,345. Will you to-morrow state the death rate from the earliest period, year by year?—Yes.

16,346. Is there anything further which you wish to state to the Commission?—I should like to confirm what has been said about Whitwood, the portion adjoining Castleford, which is not under the local board of health. Its condition as a district is quite what Mr. Heptinstall, the chairman of the local board, has stated; it needs sanitary improvement to a very great extent.

16,347. Do you think that they will be wise enough to take the steps which I have suggested, namely, to petition the Secretary of State to allow them to adopt the Act?—I should almost think that they would, for it is not many months since I was present at a meeting at Whitwood, and I think that the general feeling then was to adopt the Act. It was before the last Diseases Act passed, and the communication from the Secretary of State was rather against their being able to adopt the Government Act.

16,348. On account of the population?—Yes; but since that the new Diseases Act has been passed.

16,349. What is the population?—Between 2,000 and 3,000.

16,350. I see that at the period when the report before me was made, namely, in 1850, there was a death rate of 27·4 per 1,000?—That would be before my appointment.

16,351. Have you anything further to state?—I would make one remark about the casual outbreaks of cholera since I have had to do with Castleford, namely, that I think that they have generally been attributed

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to soakage of sewage into well-water, and I do not know that they can be attributed to the use of privies in the town. I think that they were more attributable to the liquid matter from fold-yards and other places of that sort, and to heaps of manure than to any conveniences constructed for the use of the inhabitants.

16,352. But have you reason to believe that in some degree the cholera arose from the use of impure water?—I am sure that it did, because in one or two cases where the wells were locked up, and charcoal and lime were thrown in, the cholera ceased.

16,353. Then with regard to the water supply you think that the local board have a great responsibility resting upon them if they permit any impure water to be used for domestic purposes?—Yes, if they have the power to prevent it.

16,354. Is there a difficulty in obtaining water for Castleford?—A river water has been analysed, namely, the Mere, which Mr. Heptinstall has spoken of, and there my own chemical examination proved that that water was very soft, but that there were evidently traces of chemical impurities coming down the river; it was coloured, and you could not get rid of the peculiar taste of the water, no filtration or boiling took it away; it was the exact taste of the river water; that impurity must have been produced by soaking.

16,355. (*Mr. Harrison.*) Are you at all connected with Knottingley?—Only as a medical man going down there and knowing the place well.

16,356. How is it off for water?—It is only supplied by well water; and one effect of the last flood at Knottingley was, that the people were unable to use the wells for some little time afterwards in consequence of the impure water floating over the land and finding its way into the wells.

16,357. Then should you say that Castleford and Knottingley are two striking instances upon the river Aire of towns badly situated for obtaining water from any other source than the river itself?—I should think that both of them are in that position, they could not get water except water strongly impregnated with time.

16,358. Therefore they are deeply interested in the purification of the river Aire?—I should think so more than the towns higher up.

16,359. If the rivers Aire and Calder were effectually purified, would those rivers be a suitable source of supply for those two towns?—I think so; as much as they were when I first knew them; they were then very largely used in both towns, but now they are scarcely used at all.

16,360. If those rivers were purified, do you believe that the inhabitants could not get water equally soft or equally pure from any other source in the neighbourhood?—I think not, unless they went to a very deep well.

16,361. Is Knottingley sewered?—Yes, but the sewers are merely the old-fashioned sewers; it is not under a local board.

16,362. Is the sewage turned into the river?—Yes.

16,363. You are not medical officer to the board of Knottingley?—There is no local board. I merely speak as a practitioner, knowing Knottingley and passing frequently through it.

16,364. Is there any authority in Knottingley to inspect the town and keep it clean?—No more than there is in any other town.

16,365. There is no corporation?—No.

16,366. There is no local body?—No, except what may be constituted by the poor law.

16,367. Do you know what is the condition of the town as to privy accommodation and so forth?—No.

16,368. Have you any practice in the Marshlands below?—Not much.

16,369. Is the land opposite Knottingley subject to flooding?—Yes, all Brotherton Marsh is.

16,370. Do you practice there?—There are not any houses upon the marsh, but adjoining the marsh there are some, but that is upon high land. I do not think that they would be at all influenced in the higher lands by the effects of the floods.

16,371. Does the population below Knottingley become sparse?—There is only Beal, a village below, which would be influenced by flooding, and whatever applied to Knottingley would apply to Beal in a measure.

The witness withdrew.

Mr. T. Simpson.

Mr. Thomas Simpson (Castleford) examined.

16,372. (*Chairman.*) Where do you live?—At Castleford.

16,373. Do you carry on any business?—I am a glass bottle manufacturer.

16,374. Where are your works situated?—At the west end of the town.

16,375. Do you use the water of the river?—No.

16,376. How many years have you been resident there?—61 years.

16,377. For how long can you remember the condition of the river?—For fifty years.

16,378. In what state is it now as compared to what you remember it to have been?—It is now very badly polluted, but fifty years ago it was clear and pure, and it was used for all domestic purposes. There was no other water then; there were not two wells in the town then; everybody used the river water.

16,379. What number of hands do you employ?—150.

16,380. What quantity of coal do you consume in the year?—7,850 tons.

16,381. What do you do with the ashes?—They go into the byroads to fill up holes.

16,382. Not into the river?—No.

16,383. Do you make any smoke?—Yes.

16,384. Does anybody complain of it?—There are a few odd persons that do complain; they do not derive any benefit from it, or they would not complain.

16,385. Is it possible, do you think, to carry on your business without making smoke?—I cannot say; there have been many schemes that have been brought out.

16,386. What kind of bottles do you make?—Both pale and black; the body of the glass is sand and lime and chalk.

16,387. Do you use flint?—No.

16,388. Where does the sand come from?—From Lynn, in Norfolk, by a vessel.

16,389. Is it a white silicious sand?—Both white and red.

16,390. You do not get the best quality of sand which comes from France?—No, we do not get that.

16,391. What weight of glass do you make per week?—One house per week, two tons a day.

16,392. How many houses have you?—Three.

16,393. How long have they been established?—About 22 years.

16,394. If it could be shown that you could perform all your operations at less cost by the use of gas and without smoke should you object to make an alteration?—No, we should be very glad; we should do what could be done.

16,395. Do you use coal or slack?—Both, but more slack than coal.

16,396. What do you give a ton for the coal?—For smudge, 3*s.* and 3*s.* 6*d.*

16,397. Do you get it laid down for 3*s.* 6*d.*?—No, there is the carriage besides that; it will cost 6*s.*

16,398. What will the best coal cost laid down?—8*s.* or 9*s.*

16,399. Is the smudge cheap at 6*s.* as compared with the best coal at 8*s.* or 9*s.*?—We think so.

16,400. Are you quite sure of it?—It does not take so much money as it used to take when we used coals. We have a good draught.

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16,401. Are you a member of the local board of Castleford?—Yes.

16,402. Have you had to discuss with them the questions of sewerage and water supply?—Yes.

16,403. What is your opinion; is there any hope of your being able to help your poor neighbours with a better supply of water?—We hope so.

16,404. Have you done something in the way of sewerage?—Yes.

16,405. Do you intend to do something more?—Yes; we must have the sewers ventilated.

16,406. What accommodation have you provided upon your premises for your men; any waterclosets?—No, privies.

16,407. What becomes of the refuse?—We take it out on to the land.

16,408. Is it found beneficial for agricultural purposes?—Yes.

16,409. Do you throw any refuse into the river?—No.

16,410. Ought not the river to be dealt with so as to prevent the pollution that has been going on?—It is very necessary, and it ought to be done.

16,411. Do you know that it is a common practice for people to throw solid materials into the river, such as ashes, road dirt, and foundation materials?—No doubt it is so.

16,412. Is not that done in Castleford?—I think not.

16,143. You are, I suppose, a heavy ratepayer in Castleford?—Yes.

16,414. At how much are you rated?—Not quite 400*l.* per annum.

16,415. Your rates are very heavy?—Yes.

16,416. Have the rates been increased since the local board came into existence?—Yes.

16,417. Do you think that the money is expended badly?—No, I think they use all the economy they can.

16,418. If you are better off for the money that is expended I suppose you think the money is well laid out?—Yes, the roads are better, and road making is the most costly item.

16,419. Is the health of your townspeople better than it was?—Yes, better than it used to be.

16,420. Are the poor rates as high as they used to be?—I think they are higher.

16,421. (*Mr. Harrison.*) How many hands do you employ?—150 men and boys.

16,422. How many families would they represent in the town, or how many women and children are dependent upon them?—I do not know; some of them have large families and some small ones, and they have a few apprentices.

16,423. Your works probably add to the population of Castleford 1,000 persons?—Not so much as that.

16,424. What other works are there in Castleford besides yours?—Plenty more glass works.

16,425. What number of hands do you suppose are employed?—There are 23 glass houses. I have only three.

16,426. What number of hands would they employ altogether?—Three houses will average 220 men and boys.

16,427. Has the glass trade risen in Castleford within the last twenty years?—The last thirty years.

The witness withdrew.

Mr. W. Hunt.

Mr. William Hunt (Castleford) examined.

16,428. (*Chairman.*) Do you reside in Castleford?—Yes, I have lived there the last two years.

16,429. (*Mr. Harrison.*) In what business are you engaged in Castleford?—I am a manufacturing chemist.

16,430. What description of chemicals do you manufacture?—I make sulphuric acid, sulphate of soda, muriatic acid, and chloride of lime.

16,431. Are you an alkali manufacturer?—I am just now beginning to make alkali for the glass works.

16,432. The glass manufacture has caused you to make alkali?—Yes.

16,433. Where do you get your salts from?—From Droitwich at present.

16,434. What quantity do you use in the year?—At present in this locality I use about 30 tons a week.

16,435. And that at the commencement of the trade?—Yes.

16,436. (*Professor Way.*) Do you condense the muriatic acid?—Yes.

16,437. Within the provisions of the law?—Yes, I must do that.

16,438. Within five per cent.?—Less than that.

16,439. What becomes of that acid when it is condensed?—I use it with manganese to produce chlorine for bleaching powder.

16,440. Is it all made into bleaching powder?—I sell occasionally a little muriatic acid.

16,441. (*Chairman.*) Does Dr. Angus Smith visit you occasionally?—Yes, he was there last Friday.

16,442. How often does he come?—I cannot say; he is there sometimes when I am not there; he comes in just when he likes.

16,443. He does not give you any notice when he comes?—No.

16,444. Has he an inspector under him?—It is not Dr. Angus Smith himself who comes; it is one of his inspectors; he has been there once.

16,445. Is the inspector who visits you the inspector for the district?—Yes.

16,446. Dr. Angus Smith visited your works when you first began?—Yes.

16,447. Does the same gentleman come always?—I have never seen any other.

16,448. Has he any apparatus to test what passes from your premises?—Yes.

16,449. Is it under lock and key?—Yes, in a particular place; we never touch it; he comes there and has access to it without saying anything to anyone, and is able to ascertain the state of things going on by going into the stack.

16,450. Does it indicate what is going on?—Yes; I have used the machine perhaps three times in the course of the time it has been up, not more; I have access to one myself.

16,451. Do you sell hydrochloric acid?—Yes, I sell some.

16,452. What quantity of hydrochloric acid produced in this country is converted into chloride of lime; it it all converted, or only half?—More than half. I should think that three-fourths of it are converted into chloride of lime.

16,453. Is any of it thrown away in the river?—I think not, it is too valuable for that.

16,454. (*Mr. Harrison.*) Are you not aware that a large quantity passes from alkali works on the Tyne into the river?—I was not aware of that.

16,455. (*Professor Way.*) At what price can you supply hydrochloric acid?—I am selling it now at 1*s.* 6*d.* a hundredweight, delivered on to the rails.

16,456. That is 30*s.* a ton?—Yes.

16,457. It is to be had sometimes cheaper than that?—I have sold it at 1*s.* a hundredweight, and sometimes less than that.

16,458. You do not throw any portion of the hydrochloric acid into the stream?—No, I cannot afford to do that.

16,459. Do you make sulphate of soda, the salt cake, into soda?—I have just begun to make it into white ash.

16,460. Soda ash?—Yes; I have to make sulphuric acid in order to make sulphate of soda.

16,461. There is no discharge from the chamber of any kind?—No. I have a condensing tower attached to each chamber, and after the fumes have passed

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through this small condensing tower all the gases go together into another large tower.

16,462. Do you pump the acid up to meet those gases?—No, I have not done that of late; I find that I get such perfect condensation that I do not force the chambers.

16,463. There is nothing going up them?—Nothing that is condensable; there may be azote or something of that sort.

16,464. You put acids up in the first instance to stop something that was likely to pass up the chambers?—Yes.

16,465. You now think that nothing goes up because the process is so perfect, and therefore acids are not wanted?—In the first condensing tower we get a little, but not at the other, at the large one.

16,466. Is there any form in which you at all pollute the river?—I send the muriate of manganese into the river, the chloride.

16,467. Is it not too valuable for that?—I have not turned it to any account.

16,468. Does it not precipitate sewage?—Yes, but it is too bulky; people prefer chloride of lime.

16,469. In towns?—Yes.

16,470. Have you sold any of it at any time?—Not in this locality; I have sold some little in Staffordshire for steel making.

16,471. For the purpose of introducing the manganese into iron?—Yes.

16,472. Do you make very large quantities of that chloride of manganese?—Yes, in Staffordshire; not here.

16,473. Can you sell it at a low price?—Yes.

16,474. Is it a strong solution?—It will be about 40 and 12.

16,475. You throw that into the river?—Yes.

16,476. I suppose it will be quite easy to add some lime to it, and precipitate the manganese?—I have had that in contemplation of late, and I have found that glass makers use a little manganese.

16,477. If the clear solution had a little lime mixed with it you would then have oxide of manganese, and you might let the liquid from that flow off without injury?—Yes, but it is not such an oxide as we can use for making chloride of lime; it is a sesqui-oxide.

16,478. You do not I believe consume a large quantity of coal?—About 60 tons a week now.

16,479. Is that principally used in firing the reverberatory furnaces?—Yes, for generating steam.

16,480. For the sulphuric chambers?—We have an engine to force the water up to the top of the condensers.

16,481. Have you anything further to add?—No, except as to the watercourse that empties itself into the river within fifty yards of my works. It is a great nuisance; it comes from the township of Whitwood, half a mile further west.

16,482. Do the people there discharge their sewage into the stream?—Yes; there is a great number of cottages there and very little fall, and soapsuds and other matters lie there and generate a deal of sulphuretted hydrogen, and the smell is very bad in summer time.

16,483. You would no doubt be glad if some measure was passed to compel them to abate that nuisance?—Yes.

The witness withdrew.

Mr. W. Wilson.

Mr. William Wilson (Castleford) examined.

16,484. (*Chairman.*) Are you manager of the Castleford gasworks?—No, I am engineer for them.

16,485. Do they belong to a company or to the township?—A company.

16,486. How long have they been established?—14 years.

16,487. What number of retorts have you in use?—We have five clay retorts, five iron ones, and two brick ovens.

16,488. What volume of gas do you make per annum?—About 6,000,000 of cubic feet.

16,489. What price do you charge?—5*s.* per 1,000 cubic feet.

16,490. What do you pay for coals?—About 10*s.* a ton.

16,491. What weight of coal do you use in a year?—About 900 tons.

16,492. How much coke do you make?—Something like 12 cwt. to a ton of coals.

16,493. What do you get for your coke?—10*s.* a ton.

16,494. What do you get for the gas tar?—We sell it as a whole; we make about 5*l.* a year for the tar, and for the ammoniacal liquor something like 8*l.* or 9*l.*

16,495. What do you purify the gas with?—Dry lime.

16,496. Have you any difficulty in getting rid of it?—No; we sell it at 1*s.* 6*d.* a load.

16,497. What do you do with the ashes you make?—They are carted away.

16,498. Is there any form of pollution that passes from your premises into any stream?—Not anything, nor has there ever been.

16,499. Then gas, you would say, may be made without rendering any river impure?—Yes.

16,500. If the operations in any gasworks are so carried on as to pollute a stream, do you think there would be any hardship in restraining the parties from doing so?—No; I should say there was bad management if they did so.

16,501. What number of men do you employ?—Five in winter and three in summer.

16,502. Are your works near the river?—Yes, they are close on the banks.

16,503. How long can you remember the place?—I have been in business in Castleford for 34 years. My first establishment was close by the river side.

16,504. In what condition is the river now compared with what it was then?—It is very different from what it was then. I fished in it for many an hour 30 years since.

16,505. Do you ever see any indication of refuse from gasworks coming down the river?—No, I have not noticed that; I think we have none near us that pollute the river.

16,506. Do you suffer from a deficient water supply?—Yes, we have had plenty of water in the town; but recently the sinking of a coalpit near us has taken the well water away.

16,507. Are you a member of the local board?—Yes.

16,508. Have you discussed with them the propriety of getting a better supply of water?—Yes, and the local board have engaged me to find a supply. Castleford is just in the midst of a coal field, and it is difficult to get a supply, however we found some water at a place about a mile from Castleford, but it was somewhat too hard, and we then turned to the old river. We found from analysis that it was not suitable, and we are now in hopes of getting water from another source, a colliery pit; the sinking of it drained our wells, but they are now pumping 800 gallons per minute, and we think that water will be very suitable for us.

16,509. If it does turn out to be suitable will the local board secure a supply for the use of the people?—My instructions are to set about getting it immediately; we are now testing the quality of it, and if it is found to be sufficient in quantity we shall have its quality tested more accurately, and if it proves of such a quality as will be suitable we shall certainly use it. We have a situation for a reservoir to pump the water into, and from that reservoir there is a sufficient fall into the town.

16,510. Are there any observations which you wish to make, or any facts you desire to state bearing upon this inquiry?—I believe that the local board, although it is not for me to say so, are very wishful to do everything they can to improve the health of the town. In

reference to a question put by Mr. Harrison to our chairman as to preventing the flowing back from Castleford to Knottingley, I may state that that is the first dam below Castleford, and it has a very little fall indeed. Before our local board was established we had Mr. Babbage to make a survey here, and his first idea was to carry down the sewage to Knottingley. I went with him over the district, but when he had been over it he abandoned that idea altogether, and he said that he could not get fall enough for the sewers to empty themselves. With regard to the system of sewerage which we have now we had an inspector down from London to examine the plan before it was carried out.

16,511. Is not a considerable part of the town situated on rising ground ?—Yes, a part of it.

16,512. The part where the town is being extended is on high ground ?—Yes.

16,513. Your town is a rapidly increasing one, is it not ?—Yes.

16,514. From all that higher ground there would be no difficulty in carrying the sewage on to the land below ?—We might carry it from the higher part of the town on to the land below.

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16,515. In carrying out your system of sewerage would it not be well to keep that point in view and lay out the sewers so that the sewage from all the houses that are likely to be built in the upper parts of the town might be carried down and used to irrigate the land below ?—Yes, and it shall not be forgotten. I am indebted to Mr. Hunt for an analysis of the water I have spoken of, which I will hand in (*handing in the same*).

16,516. (*Professor Way.*) The water that you spoke of before, and which was analysed by Mr. Newsome, came from an old mine ?—Yes.

16,517. You know that that is very alkaline ?—Yes, and we have abandoned that water.

The witness withdrew.

Adjourned till to-morrow at 11 o'clock.

Pontefract, Saturday, 1st December 1866.

PRESENT :

ROBERT RAWLINSON, ESQ., C.B., IN THE CHAIR.

JOHN THORNHILL HARRISON, ESQ. | Professor JOHN THOMAS WAY.

Mr. JOHN CARTER (Knottingley) examined.

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16,518. (*Chairman.*) What are you ?—I am a brewer at Knottingley.

16,519. You carry on your business at that place ?—Yes.

16,520. Are your works situated near the river ?—Near the canal.

16,521. Where do you obtain your water ?—From a well of our own.

16,522. What class of water is it ?—It comes from the magnesian limestone in our neighbourhood ; it is hard.

16,523. What volume of water do you use in a week or a month ?—I cannot say.

16,524. You pump it ?—Yes.

16,525. How long have the works been established ?—For 60 years.

16,526. What quantity of beer do you brew in a year ?—I cannot say.

16,527. Is it a large or a small quantity ?—It is a large one.

16,528. Do you brew pale and bitter beer ?—Yes.

16,529. For the foreign market ?—No.

16,530. Is your hard water better suited for pale beer than a softer water ?—We do not find any very great difference.

16,531. I believe Burton water is hard ?—Yes ; it was supposed by many people that Burton water was always taken from the river, but that is wrong ; the brewers there have wells of their own.

16,532. Are their wells in the same stratification that yours are in ?—No, I think not ; I think their wells are more in gravel.

16,533. With regard to the water you use in washing out casks, and other waste water, what becomes of that ?—It goes into the canal.

16,534. Has that been objected to at any time ?—Never ; upon that part of the canal where the water goes into the Aire and Calder they have never made any objection to it.

16,535. How many men do you employ ?—23 or 24.

16,536. What becomes of the sewage from your premises ; have you aspits and middens ?—Yes ; the sewage does not go near the canal.

16,537. I may assume that you do not pollute the stream ?—Not at all, except by the water from the washing of the casks, which goes into the canal.

16,538. And the canal people do not find fault with it ?—Never.

16,539. Have any of your neighbours found fault with it ?—Never.

16,540. Have you any other remarks to make ?—Simply this : I think that the reservoir near to Pontefract has ruined the nice stream that used to flow down into the river. I often perceive, in driving up in very hot weather, a stench from the reservoir.

16,541. That is a sewage tank, is it not ?—Yes.

16,542. Which the Pontefract people have made ?—Yes.

16,543. You think, if they wish to do their duty to themselves and their neighbours, they might find some other method of removing the sewage than putting it into that tank ?—Decidedly.

16,544. Have you no such tank connected with your premises ?—No.

16,545. (*Mr. Harrison.*) The liquid sewage after passing from the tank goes into the canal, and is then conveyed through Knottingley ?—Yes.

16,546. Where do the people of Knottingley obtain water for domestic purposes ?—Many of them obtain it from the canal.

16,547. Do you think that that is a desirable state of things ?—By no means.

16,548. Could you dispose of your refuse otherwise than by passing it into the canal ?—No, we could not ; it is impossible.

16,549. Could you filter it ?—I do not know whether we could do that or not.

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16,550. It is not any large volume of water, is it?—Yes.

16,551. How many gallons do you use in a day?—Many hundred gallons; I cannot speak to the quantity exactly.

16,552. After all, when the waste liquid goes out of the brewery into the canal, it is merely discoloured water; there is no kind of refuse in it, is there?—No.

16,553. It was stated yesterday that at the brewery near this place there was some kind of refuse which was very objectionable?—Yes; I understand that they throw in refuse hops, and sometimes grains; they can be sold for manure. We never let them go into the canal.

16,554. (*Chairman.*) I suppose hops become putrid and stink?—Yes, but they are generally led away from the place at once; we sell them to a farmer, he takes them away every three or four days if they are objectionable. There is nothing that goes into the canal from our premises except the washings of which I have spoken

The witness withdrew.

R. Moxon, Esq., J.P.

RICHARD MOXON, Esq., J.P. (Pontefract), examined.

16,555. (*Chairman.*) Where do you live?—At Pontefract.

16,556. Are you engaged in any business?—I am in the malting trade.

16,557. Do you use much water?—A good deal; we use the town's water, and we pump a large quantity from a spring of our own coming from the limestone.

16,558. Where does the waste water go to?—The waste water from the malting premises, after the barley has been steeped, runs into the town sewer and goes down to the tank.

16,559. How many men do you employ?—From 50 to 60 at least.

16,560. Have you privy accommodation on the premises?—Yes.

16,561. Does the refuse go into the sewers?—No, we have ashpits behind, and the refuse is carted on to land by ourselves.

16,562. Is there any waste of any kind from your premises that goes into the stream besides what you have mentioned?—Nothing but from the maltings; the water rather smells, and is objectionable in the spring, but it has been found to be rather an advantage to the sewers, as the large rush of water has sometimes tended to cleanse them.

16,563. If that water, after the malt has been steeped in it, could be put on to land by way of irrigation would that be beneficial, do you think?—No doubt it would be highly beneficial; perhaps no town in England affords such a fall for carrying sewage or refuse away as Pontefract.

16,564. You think that if the Pontefract people were to put their shoulders to the wheel, and to look about them and do what they could, they might find ground to put the refuse on?—Yes, no doubt of it; I have been in the corporation more than 20 years and am also one of the Street Commissioners. The difficulty is that there are two governing bodies; there are 16 members of the corporation and about 32 of the Street Commissioners, and the one body clashes against the other. I have tried as hard as I can, but you can get no permanent improvement made except by compulsory means.

16,565. Do you know that if two-thirds of your number would vote for the adoption of the Local Government Act it might be put in force?—Yes; and I have brought that subject before the corporation, and if I could have carried it I would never have left the corporation; it would have been a great blessing.

16,566. There is a divided responsibility; the Street Commissioners have jurisdiction in one way, and the corporation is supposed to have jurisdiction in another way?—Yes, and they pull contrary to each other; we can get no drainage carried out. The only drain that there is I got constructed, but there is no shaft to it.

16,567. The Street Commissioners who have charge of the pavements and the sewering and other improvements are not amenable to the ratepayers?—No, they are not amenable; they do not produce any account to the ratepayers; they do not show any accounts to the inhabitants how the money is expended. Supposing it happened that a set of idiots being owners of property were elected, you could not turn them out of office; whatever mistakes they might make you could not bring them to book.

16,568. If the ratepayers of Pontefract, who have the matter in their own hands, would elect into the council men pledged to bring in the Local Government Act, the commissioners must go out?—They will not elect any men into office who are desirous of making any improvements; if they are disposed to spend any money they must not go into office. Candidates may make flowery speeches, but if they attempt to effect any public improvement they will never get in. I have always recommended that the area of the borough should be extended, and then the ratepayers would be able to appoint and pay a competent surveyor. Until that is done, they have no power except to appoint a few old women to hospitals; there are 16 members of the corporation, and I do not believe there is a worse paved town in England than this is. Although I am the largest ratepayer I cannot compel them to pave the streets, but I do not intend to pay any more unless they pave the streets. I am willing to pay anything if they pave the streets and drain them.

16,569. (*Mr. Harrison.*) It appears that in Pontefract the death rate is 26 in 1,000, whereas that of the adjoining town of Castleford is only about 16?—I believe that if Pontefract was properly attended to in water supply and drainage there would not be a healthier town in the United Kingdom, with such a fall as it has. In my house I have adopted a method of flushing. I have a large cistern, and I let the water out and flush the drainage. If that was done in the town, or the sewage was carried away, it would be greatly better; the new drain at a cost of 1100*l.* has really done more harm than good; the stench from it is unbearable.

16,570. Do not you think that the corporation and the commissioners, in dealing with the money collected in the town, should seriously consider the question of the health of the inhabitants?—Yes, most seriously; we wish that the Government would send down a commissioner to report and inquire upon the matter, and say, If you will not do what is necessary we will compel you, for what can one individual do in the matter?

16,571. We sincerely hope that the ratepayers will take the whole matter into their consideration, looking at what has been done elsewhere, and remembering that neglect is most expensive in the end, and that divided government is not only inconvenient and cumbersome but inefficient?—I quite agree, sir, with every word you have spoken. I was turned out because it was found I was in favour of getting a better supply of water. We are suffering from a great hardship, for, in addition to the pollution that we make ourselves, we have all the drainage of Tanshelf emptying itself into the watercourse.

The witness withdrew.

JAMES HORATIO SIMPSON, Esq., M.D., further examined.

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J. H. Simpson, Esq., M.D.

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16,572. (*Chairman.*) You wish, I believe, to add something to your evidence?—Yes; you asked me to give you a return, if I could, of the number of deaths from 1860 to this time. I cannot give it you for the whole number of the months, but I can give it you for nine months in each of the following years, from 1860 to 1865. I can also give you the number of adults who died of fever, and it will appear that there has been a diminution.

16,573. As improvements have been carried out you find that the fever death-rate has diminished?—Yes. In 1860 I do not know the number of adults that died from fever; in 1861 the number of adults who died from fever was 7 out of 88; in 1862 the number of deaths in nine months was 89, and that of deaths from fever of adults 9; in 1863 in nine months the deaths were 78, there being 4 adults who died from fever; in 1864 in six months there were 54 deaths, and 3 adults died from fever; in 1865 in six months there were 57 deaths, and 3 adults died from fever—by adults I mean persons between the ages of 18 and 50. The cases of fever are generally at the part of Castleford adjacent to the township of Whitwood, where no sanitary measures are adopted. I may also state that the population of Castleford as well as of Whitwood has increased by more than one-third in the six years of which I have given you the death-rate.

The witness withdrew.

GEORGE PAUL ATKINSON, Esq., M.R.C.S. (Pontefract), examined.

G. P. Atkinson, Esq., M.R.C.S.

16,574. (*Chairman.*) Are you in practice in Pontefract?—Yes.

16,575. How long have you practised here?—In this neighbourhood nearly 25 years.

16,576. What is the state of public health now as compared with what it has been within the period of your recollection?—I am of opinion that fever and epidemic diseases have decidedly increased upon us.

16,577. They have been increasing for some years past, and you have carried out, or rather the commissioners have carried out, what they consider to be an improvement in main sewerage, at an expense of some hundreds of pounds, but not with any beneficial effect, is that so?—I must be understood not to express myself as to Pontefract merely, as I have only resided here for seven or eight years. I have also resided in the immediate neighbourhood, close to the boundary of the borough.

16,578. As to Pontefract, do you know anything of its special conditions?—I believe there are many conditions which contribute to the heavy death-rate of Pontefract.

16,579. What are those conditions?—There are social conditions which tell as well as ordinary causes, like neglect of sewerage.

16,580. What are those social conditions?—I think there is an excess of intemperance.

16,581. Do you think that bad cottage accommodation and bad sanitary arrangements at home have anything indirectly to do in compelling men to resort to public-houses?—I do think that the alleys of this place are very narrow and confined. It is an old built town, and there are many houses on a small space.

16,582. Crowded together?—Yes.

16,583. If they have privy accommodation of any kind, is it situated close to the dwelling house?—I am sorry to say that the accommodation is very variable; in some of the old parts of the town it is deficient; but I am speaking now more particularly of old alleys which constitute the old part of the town.

16,584. Have you any remarks to offer to the Commission, from your experience in these matters, as to sewerage or outfalls?—My opinion is that the state of the sewerage is not so perfect as it might be. I think that offences have been frequent in the course of the sewerage, and likewise down at the outfall tank.

16,585. Has it occurred to you that any other system would tend to get rid of these nuisances?—Yes. I have been of opinion that it was desirable to adopt some definite system of disinfection of the sewers in order to counteract and destroy the offensive and injurious gases which prevail there.

16,586. Are you aware that if sewage could be passed away fresh, day by day, and could be placed on land for agricultural uses, it never would be offensive?—I am aware that land acts as a deodorizer of sewage.

16,587. Are you aware that the effete matter of to-day is not corrupted to the same extent as it would become this day month?—Certainly.

16,588. That is a self-evident fact?—Yes.

16,589. If the effete matter of an individual would become corrupt and foul by keeping, it is clear that the effete matter of a town, if kept by any arrangement, as in these sewers and tanks, until putridity sets in, would become a mass of corruption and be offensive and dangerous?—Yes, certainly.

16,590. Then if it were possible to deal with that matter daily as it is produced, and thereby to prevent decomposition, you would get rid of that form of injury?—Certainly, and that is my object.

16,591. When you say disinfection, do you mean disinfecting by chemicals?—Yes.

16,592. But chemicals cost money?—Yes; they do.

16,593. You have an amount of mischief set up, and you propose to attempt to remedy that by using chemical disinfectants?—Yes.

16,594. If you caused the material to be used before putridity was set up, you would require no chemicals. I mean if the material was put on the land?—No; but at present we are not in a condition to do that.

16,595. Would it not be worth the while of the Street Commissioners to rent two or three acres of land and relet it with the condition that the farmer should apply the sewage daily to it?—I should not object to utilizing sewage on land, on the contrary I have always approved of it; but I speak with reference to the present state of things, and I argue that the present state of things is one fraught with considerable danger.

16,596. And expense?—Yes, certainly. But I look at things as they exist this year and will exist next year, and I argue from that that something is really called for, and that something I believe to be a system of disinfection, as the only means that we have to meet the difficulty.

16,597. That is for immediate purposes?—Yes, or until some different system can be adopted.

16,598. I suppose it would be within the province of the commissioners to use disinfectants?—I apprehend it would.

16,599. And not the corporation?—I am not able to say. There is a sanitary committee and an inspector of nuisances.

16,600. But they are not empowered to construct sewers, are they?—I believe not.

16,601. That falls to the commissioners to attend to?—Yes.

16,602. And the commissioners are not amenable to the ratepayers?—I believe not.

16,603. They are not elected by them?—No.

16,604. The ratepayers choose to be governed by men whom they have no control over and cannot direct in any way?—Yes.

16,605. They can neither elect them nor turn them out?—No.

16,606. If the Local Government Act was put in

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force all the officers might be elected by the ratepayers?—Yes.

16,607. One-third of them must go out every year, and appeal to the ratepayers again for re-election, so that the whole local government of the place would be regulated by direct appeal to the ratepayers, year after year?—Yes.

16,608. Your government goes on without any appeal at all to the ratepayers?—Yes, and I am sorry for it. I wish to say, in connexion with the suggestion I have made, that I believe one of the most powerful means of relieving the present foul conditions of rivers would be to employ a system of disinfection habitually, because the deposit as it would reach the rivers would be accompanied by the disinfectant, and so long as the present system prevails of pouring the sewage into rivers I hold that an offensive and injurious deposit will take place there, and ought to be disinfected by some means until a better system is provided.

16,609. But it would be one of the most costly and inefficient methods that could be adopted. In Leamington they put up at great cost tanks to receive their sewage, and they were indicted for a nuisance below; they used disinfectants to the extent of 3*l.* sterling, day by day, but they were still liable to prosecution, and the nuisance was not abated?—Probably they attempted to convert the refuse into manure.

16,610. No; they simply attempted to make the effluent water from the tanks innoxious. In Cheltenham they used the most powerful disinfectants, with a like result?—I do not doubt the benefit of applying sewage to land, but I think if sewage was conveyed to the rivers disinfected the result would be what I have mentioned.

16,611. The land is the only true disinfectant?—I think it will be a very long time before that plan is adopted, because improvements go on so slowly.

16,612. Have you anything further to add?—Yes. I have observed a deposit in the water in this town; the water I think would be improved by filtration.

16,613. But that water is drawn from a well, is it not?—Yes, but there is a deposit frequently.

16,614. Of what character is that deposit?—It is a mineral deposit.

16,615. Is it in the shape of carbonate of lime?—It is principally lime.

16,616. Does that deposit take place when the water is exposed to the open air?—Yes, and sometimes it is considerable.

16,617. (*Professor Way.*) Is the water clear?—No, it is not perfectly clear.

16,618. You mean that there is a sediment?—Yes.

16,619. Not in chemical solution?—No.

16,620. (*Chairman.*) That is a matter to be dealt with by the persons supplying the water?—Yes. I should have been happy to have added something, but I will not detain the Commissioners any longer.

16,621. Be good enough to give us any information that you wish to lay before us?—I have here a copy of a letter from a surgeon in Keswick, and of disinfection he says that when small-pox prevailed to a great extent, he succeeded entirely by the use of disinfectants in abating the epidemic.

16,622. What is the name of the surgeon?—Dr. Leitch. I do not wish people to rely upon disinfectants, but I think they are valuable agents, especially during the prevalence of epidemics, and hitherto I believe the public have not had a tithe of the benefit they might have had from their use; it is too often forgotten that in removing night soil without previous disinfection most injurious gases are liberated, and these frequently play an important part in the production of epidemics.

16,623. Where you have no other means of removing filth?—Yes.

16,624. If you had a dirty floor you might make it less injurious to your health by sprinkling lime over it, but a brush and a mop and water would answer the purpose a great deal better, remove the dirt and you would not require a disinfectant.

16,625. (*Mr. Harrison.*) I presume you consider that prevention is better than cure?—Certainly; that is the whole ground of my advocating disinfectants; they are means of prevention.

16,626. If you prevented disease by a thorough system of sewerage, and by applying the sewage to land, which you can do here with facility, you would have no occasion to seek for a remedy to the disease?—When you can succeed in carrying that system out I admit it will be the very best thing; but I do not think that it will be done until it is enforced.

The witness withdrew.

The following note was added by the witness to his evidence:—

I think it would be a great blessing to the people here if the Government were to order an independent and rigid inquiry into all the causes of the present very high rate of mortality, as there appears to be no prospect of the matter being properly attended to without such an inquiry take place.

H. Muscroft, Esq., L.R.C.P.

HENRY MUSCROFT, Esq., L.R.C.P., of London (Pontefract), examined.

16,627. (*Chairman.*) I believe you are a surgeon practising in Pontefract?—Yes.

16,628. Are you the sanitary medical officer of the town?—Yes.

16,629. Appointed by the corporation?—Yes.

16,630. Can you tell us what the death rate in Pontefract has been for some years past?—The death rate at Pontefract for the last five years, calculating from the 1st of August in one year to the 31st July in the next year has been, between 1861 and 1862, 14·8 per 1,000; between 1862 and 1863, 17·09; between 1863 and 1864, 23·38; between 1864 and 1865, 24·67; and between 1865 and 1866, 29·1.

16,631. That shows a very rapidly increasing death rate in the borough of Pontefract?—It does.

16,632. Is that in the municipal borough?—Yes; it includes Pontefract, Tanshelf, and Monk Hill.

16,633. How do you account for that strikingly increasing death rate in the borough of Pontefract?—In a great measure by the imperfection of our sewerage arrangements and deficiency of water supply. Seven or eight years ago, when the modern improvement of waterclosets was more generally adopted, their contents entered into the drains of the town. Now we have an extremely small supply of water, and the consequence is that in dry weather all the drains of the town are little better than cesspools. There is a very imperfect system of trapping, and the wind, when it is in a certain direction, causes a stench to arise.

16,634. When was the sewerage carried out?—I think in the year 1854, before I was in practice here.

16,635. The water supply was obtained some years before that, was it not?—I believe shortly before that.

16,636. In what year was the water company established?—About 14 years ago.

16,637. Then the so-called improvements up to this time you consider have really been no improvements at all, but the contrary?—Yes.

16,638. To those so-called improvements being badly carried out you attribute the increasing death rate in Pontefract?—I do not say that they are the sole cause, but at all events they are one cause.

16,639. What other causes are there?—The death rate of last year, 29 per 1,000, appears to be a very high one, but little more than a year ago the union was established here, and so a number of old people were brought in from the country, and those old people dying, as they naturally would do, have rather in-

creased our death rate, but only in the proportion that I have calculated it. I find that last year out of 181 deaths eight were those of persons who had come to the town a few months before, but still the death rate is a remarkably high rate.

16,640. Did you hear what was said by the last witness as to the difficulty arising from their being two authorities in the town, and as to the advisability of having one responsible and concentrated authority?—Yes.

16,641. Does that alteration strike you as being necessary?—Yes, very necessary, I may say almost absolutely so.

16,642. Otherwise I suppose you will go on as heretofore, and instead of improving the health of the town you will be rather increasing the death rate?—Yes; the death rate in five years has almost doubled.

16,643. Are you in practice in Knottingley?—No, I am not; I have very little practice there.

16,644. You are aware, I presume, that the sewage of Pontefract passes now into the canal?—Yes, at Ferry Bridge.

16,645. And that the inhabitants of Knottingley use that water for domestic purposes?—Yes, they do.

16,646. Is not that a very objectionable state of things?—Yes, very reprehensible.

16,647. In both ways, as a duty to their neighbours and to themselves, it appears incumbent upon the inhabitants of Pontefract to take some steps to remedy the mischiefs which exist, does it not?—Yes, it does.

16,648. Is there any other point that you wish to mention?—I may mention that the water, from an analysis we have made this week, appears to contain nitrates. It is possible that this may arise from some imperfection in the construction of the pipes, because, when samples of the same water sent by me direct from the springs have been analyzed, a more favourable account has been given. Analysis, however, has not been made for salts of ammonia, and if any exist in the water at the spring, their complete oxidation, (*i.e.*, conversion into nitrates) may take place in the pipes under the influence of the air held in sollution, and perhaps even more especially by the recognized action of iron upon such oxidizable states of organic matter. The water is taken from a spring about half a mile off, in Tanshelf.

16,649. There are some wells in the town, I believe?—Yes, private wells.

16,650. Have you known in any case the water in those wells to be objectionable?—Yes; it has been decidedly impure near the mill dam at the other end of the town; it is very impure at certain times of the year—in summer.

16,651. When that is the case do you take any steps to prevent that water being used?—We have done so in this particular case, when we noticed its bad condition. I do not know that any special steps were taken. You must know that the water supply for Pontefract is the town's water; there are very few private wells; this is an exceptional case.

16,652. (*Professor Way.*) The well is about 45 feet deep, is it not?—I believe it is 50 feet deep.

16,653. It is not impossible, is it, that drainage from cesspools might get into it?—It is a porous soil, that is the only chance. I may say that we are in the midst of inquiry upon this subject. It was only three days ago that I knew of the fact I have just mentioned. I was astonished to hear that the water was so impure. When the water is taken directly from the springs before it comes into the town the same analyser tells me that it is comparatively free from nitrates.

16,654. There may be some leakage into the well?—Yes, there may be.

The witness withdrew.

Mr. William Brooke (Water Fryston) examined.

16,655. (*Mr. Harrison.*) Do you reside in this neighbourhood?—Yes, at Water Fryston.

16,656. Do you farm land in that neighbourhood?—Yes, 300 acres of land, under Lord Houghton.

16,657. Does any of that land join the river Aire?—Yes, a good portion of it.

16,658. What may be the value of the best part of that land?—3*l.* an acre is the rent for it.

16,659. Do the cattle upon that land drink the water of the river?—Yes.

16,660. Is that the only water which they can obtain?—Yes.

16,661. What may be the produce of that land annually per acre to you as a farmer grazing it with cattle?—We reckon that it will feed at the rate of a bullock an acre.

16,662. And that bullock during the 12 months will give you a return of how many pounds upon the average?—It depends upon circumstances, but perhaps 4*l.*

16,663. We have had it mentioned to us that a short distance below Leeds the water of the Aire is not suitable for cattle to drink, and that in fact they will not drink it. Supposing the water of the Aire to be reduced to that condition adjoining your land so that cattle could not drink it, to what extent would the value of that land be reduced to you as a farmer?—I should say that if cattle would not drink the water the land would only be worth 2*l.* an acre instead of 3*l.* an acre, because we should be forced to pasture it with sheep, but the sort of grass which grows there is not proper for sheep; it is too coarse for them, and they would not do so well upon it as bullocks would if the bullocks got plenty of good water.

16,664. Do you find that that grass is suitable for cattle after a flood, such as has just occurred?—I do not think that the flood will do any harm.

16,665. Does it improve the grass?—Yes; next summer the land will get dried, and the grass will spring through the surface, and I fancy that the land will grow a better crop.

16,666. Do you find it necessary to be cautious after such a flood as this in turning the cattle in the spring on to such grass as that?—Yes.

16,667. Does it produce irritation and scouring in cattle?—Yes; we let them go into the meadow for a short time and then take them out.

16,668. Have you observed ill effects of that kind increasing of late years?—No, I cannot say that I have.

16,669. Are there many people residing within your district at or near the river Aire?—There are a few cottages.

16,670. Where do the inhabitants of those houses get their supply of water?—From the river.

16,671. And they drink that water?—Yes.

16,672. Do you consider that it is suitable for drinking purposes?—They can get no other; they put it in pots and pans and let it remain for two or three days to settle, and then they drink it.

16,673. After it has settled is the water discoloured?—It is not perfectly clear, but it is pretty well clear.

16,674. And they are obliged to drink it?—They have nothing else.

16,675. If the river goes on being polluted in the same degree as it has been, do you think that they will be able to go on drinking the water of it?—I do not know; they drink it at present.

16,676. How many acres of the 300 which you occupy were covered with water in the last flood?—Perhaps about 50.

16,677. Have you any notion of the area of land which has been flooded by the late flood between Castleford and the junction of the Aire with the Ouse?—No.

16,678. What height was the water upon your land?—In some places it was two yards deep.

16,679. How much would that be over the bank

PONTEFRACT.

Mr. W. Brooke.

1 Dec. 1866.

which exists between your land and the river?—I should think that it would be one yard above the bank.

16,680. Then do you think that by raising that bank four feet higher the flooding of your land might have been prevented?—In ordinary floods the bank which we have would turn the water, but that was not the case in the last flood.

16,681. If the bank were raised about four or five feet higher than it is now would it prevent the flooding of that land?—It might, but the water got to such a height this time that no ordinary bank could withstand it.

16,682. Would it be an advantage to your land if there were a bank high enough to prevent floods, and if means were provided at the same time to let the water pass from the river over your land, under control, for the purpose of irrigating it?—You could not do it. If we had to raise our bank it would throw the water to the other side of the river.

16,683. It must be raised on both sides if it is raised on either?—Yes; on one side we have a bank, but on the other side they have none.

16,684. Are they more subject to flooding than you are?—Yes.

16,685. Do you find the floods come down more or less frequently than they used to do?—We have not had any flood of importance for some time except the recent flood.

16,686. Do you find any disagreeable smells from the river in a hot summer, such as the summers of 1864 and 1865?—Yes, the river is very offensive in hot weather.

16,687. It causes discomfort. Do you know any case of its causing ill health?—I cannot say.

The witness withdrew.

Mr. W. Worfolk.

Mr. William Worfolk (Knottingley) examined.

16,688. (*Chairman.*) Where do you reside?—At Knottingley.

16,689. What business do you carry on?—Shipbuilding.

16,690. How long have you resided there?—With the exception of about two years ever since 1824.

16,691. You have known the river, then, since that period, more or less?—I have known it all my life.

16,692. Upon what river are you situated?—The Aire and Calder.

16,693. Is it worse now than when you first knew it?—Considerably.

16,694. Is it offensive to your business in summer?—Not to my business.

16,695. I mean to your workmen individually?—It is not injurious to our working, because a vessel will swim in muddy water.

16,696. Is it offensive to your nose?—I cannot say that it is, but it is not fit for domestic use.

16,697. Used it to be so?—Yes, perfectly.

16,698. Up to what time did you use it for domestic purposes?—They use it now.

16,699. Bad as it is?—Yes.

16,700. Does it ever affect the people in any injurious way?—We are very often afflicted with diarrhœa and cholera. In 1832 Knottingley was probably one of the worst punished places in the kingdom, and in 1848 or 1849 we had the cholera, but not so bad as in 1832.

16,701. Have you had any cases of it this summer?—We have had several cases.

16,702. Do the drains from Pontefract annoy you?—They run into the stream the same as all other foul water.

16,703. Into the Goole canal?—Yes; formerly the drain from Pontefract went under the Goole canal with a culvert and emptied itself into the old river; but perhaps 30 years since, or before then, the culvert blew up, and since then it has emptied itself into the Goole canal.

16,704. The culvert has never been restored?—It has never been restored.

16,705. What is the population of Knottingley?—I cannot speak to the exact number, but it is nearly 5,000.

16,706. You have adopted the Local Government Act, have you not?—We have done so. We adopted it about four years since, but we have never carried it out.

16,707. You have not appointed a local board?—No; that was the only thing in which we were deficient.

16,708. You have adopted it to keep the Highway Act from coming in?—Yes; I have always been of opinion that the Local Government Act would be a beneficial thing for us, and I have stood it out to a great extent.

16,709. But you have never appointed a surveyor, nor elected a local board, nor done anything?—We have done nothing whatever. It has cost me a good sum of money to try to carry the Act out, but some of our gentlemen have another and a selfish motive. They calculated that the effect of the Local Government Act would be that the land, and the navigation, and the railway would be able to claim a reduction of three-fourths of the highway rates; they therefore considered that they would be losing by the Local Government Act, and in the very last session of Parliament they succeeded in getting a clause put into a bill to rescind the adoption of the Local Government Act.

16,710. So that you are now without it?—Yes.

16,711. It just fenced off the adoption of the Highway Act?—Yes.

16,712. You therefore adopted the Local Government Act, but have done nothing since under it?—Just so.

16,713. (*Mr. Harrison.*) Are you not now liable to be included in the Highway Act?—Decidedly.

16,714. So that you have had all your trouble for nothing?—Yes, and rather worse. My opinion is still that no government would be so good for us as the Local Government Act. With regard to the Pontefract drainage, when they made the main sewer they made some cesspools, but those cesspools are now of no use, for this reason, they are, I believe, full of sediment, and they have not been cleaned out for two or three years, and therefore the whole of the sediment of Pontefract comes down in the water to Knottingley.

16,715. (*Chairman.*) They choose to retain this refuse here until it stinks and sets up a putrid action and becomes a worse nuisance, whereas if they had no cesspool at all and let you get it day by day you would only have the whole of it as you have now, but you would have it much less offensively?—Just so.

16,716. Do you think that there is any chance of the people in this locality learning good practical common sense;—I think not. I think that they will learn selfishness.

16,717. What is to become of them if they will not learn that neglect produces disease, and destroys the working man's life. I suppose you know that the health of a working man is his property?—Of course.

16,718. And that in order to keep that which is his property in the best possible state for earning his livelihood he must have the means of health?—Yes.

16,719. And that if he is compelled to drink dirty water, to breathe foul air, and to suffer other inconveniences, he goes prematurely to his grave, and perhaps his wife and his children become paupers, if they do not die also?—Of course. In my opinion the water of the river ought if possible to be prohibited for domestic use.

16,720. You think that the Government should step in in some way or other to protect people from their own folly?—I think that people should make an effort to do it themselves.

16,721. And you think that there should be some power to prevent the people using the river in its

present polluted form and to find them better water?—Of course; many of our inhabitants have no pumps or wells, but fetch the water from the river and canal for every purpose for which they require it. Originally the river water was considered the best water which was to be had. I have known some old people go half a mile for the river water to make tea with, as it was good soft water; but now, if a vessel lies in our canal for a fortnight or three weeks I can scrape slime off it, slime completely full of little red worms, and if you put a rope into the water and let it remain for two or three weeks you can strike the stuff off, the stuff is all alive. Thirty years since I could see, on a fine summer's day, thousands of fish on the top of the water in certain places, but we now scarcely ever see a fish; I would also observe that the banks of the river are too low. We have been tremendously flooded by the last flood. Our gasworks have been flooded to the extent of seven or eight feet deep, and we were seven nights in darkness for want of gas.

16,722. Do you think that the last flood was as great as any flood which you remember?—It was rather larger.

16,723. Have you any bench marks of former floods about your place?—Yes, within a short distance of the place where I reside.

16,724. How high did the last flood rise in vertical height from the summer level?—It depends upon the part of the town where you take the measurement; the water rises a good deal more below the dam than above the dam; about midway between the two dams I should think that the water would have risen about 12 feet.

16,725. Then the persons who gave us evidence at the commencement of our inquiry that the floods were less now than they used to oe, and that they never expected to have any more floods, have been very much deceived?—I believe that this last flood has been about three inches higher than any man ever knew a flood here before.

16,726. Have you any record in your premises of a flood which took place in 1775?—We have no record of it; you are alluding to the Leeds bridge. There seems to have been such a flood. We learn that that flood occurred at the breaking up of a frost, and the bridge archways were blocked up with ice, which accounts for the water flowing so much higher above the bridge than it did below the bridge at that time.

16,727. The waterway was blocked up with ice, and therefore the height of the water at the bridge is no test of the actual height of the flood?—No test at all.

16,728. And this last flood you think may even have been higher than the flood in 1775 was?—I believe that it has been so in most parts.

16,729. You are aware that it has done a great deal of damage on the banks of the river and on the river itself all the way up?—Yes.

16,730. To the extent of many thousands of pounds?—I can only judge of it by what I read; it has floated vessels into fields.

16,731. Where has that been the case?—About Bottomboat; some vessels have been floated a considerable distance, and some just over the bank.

16,732. How much water will your lighters draw?—About two to three feet.

16,733. Then even a loaded vessel would have gone over?—No.

16,734. It would have knocked down the bank?—Yes.

16,735. If you had had a vessel of 100 tons with 30 or 40 tons in her, do you think that one of those river banks would have stopped her?—I think so, they are a good width.

16,736. They are about a yard wide on the top?—Yes, but they have a good bottom. At Bottomboat I believe that eight or ten vessels have floated into a field.

16,737. The people had to put ways under them and to launch them back again?—Yes. I should think that we have had from 100 to 200 houses at our place all flooded, and during the inundation the people had to be supplied with their necessaries, coals or bread or water, by boat; we had to boat about and to see who was in want.

16,738. That was also the case in Leeds?—Yes, but it was carried on with us for some days.

16,739. When did the flood rise to its greatest height with you?—On the Saturday afternoon, the 17th of November.

16,740. At what time?—I should think that it was at its highest about 1 or 2 o'clock; it fell a little towards night, and then it rose again.

16,741. Did it rise to its original height?—Not quite, but very nearly so.

16,742. Did it rain very heavily with you?—Tremendously.

16,743. For how long?—The whole of the Friday.

16,744. It began on the Thursday night?—Yes, and it rained right away to some time on the Friday night.

16,745. Did it rain on the Saturday?—I think not.

16,746. Have you ever floods rising with you when you have no rain at all?—Yes.

16,747. The water comes down from the upper hills and you have fine weather?—Yes.

16,748. What height will those floods rise?—They will rise to various heights; they will sometimes rise within a few inches of what the recent flood has been when we have had no rain.

16,749. Is there anything which you wish to add to your evidence?—In our place we are greatly punished in respect of drainage; we have no proper drains at all; there is scarcely a drain in the town where you can get a shovel to clean it out.

16,750. I suppose that you have discussed that subject with the parties there and that they will not do the work?—No. We have a surveyor for one year, and at the end of the year we change him and have some one else, and he says, "I must be as careful of "the money as I can, and show as good an account as "my predecessor."

The witness withdrew.

Adjourned *sine die*.

Subsequently to the inquiry at Pontefract the Commissioners received the following letter:

To the Royal Commissioners for inquiring into the best means of remedying the Pollution of Rivers, 2, Victoria Street, Westminster, S.W.

Ledsham Vicarage,
South Milford, Yorkshire,
December 4th, 1866.

GENTLEMEN,

IN the porch of the parish church of Ferry Fryston, situate about 200 yards from the bed of the river Aire, there is an old chisel mark, showing the height which the water reached in the great flood of the year 1775. From the character of the figures, and the tradition that confirms them, there is every reason to believe that this mark was made at the time of the overflow, which it commemorates. As it is generally supposed that this is the highest flood hitherto known in the valley of the Aire, it is a matter of much interest to compare the height of the water then with that which it reached on the disastrous 17th of last November. I therefore measured the difference between

the old water mark of 1775 and the line which the recent flood has left recorded unmistakeably on the whitewash of the porch, and the result is that the flood of 1866 was 6½ inches higher than that of 1775. I noticed a peculiar slimy deposit on the flagged causeway leading to Ferry-Bridge which emitted a nauseaus smell, and required to be scraped off before it could be got rid of. I was informed that the water had risen 11 feet 6 inches during the course of Friday and Saturday the 16th and 17th of November. As the valley is wide at this point, there could not be a fairer place for measuring the intensity of a flood, the main characteristics of which appear to have been the suddenness with which it rose, and the rapidity with which it subsided.

My parish (Ledsham) is I cannot say washed, but polluted by two or three miles of this once beautiful stream, from which the cattle in the heat of summer have been seen to turn away with loathing, and from which every description of fish has gradually disappeared. In former times, they used to be found in quantities on the meadows when the water had subsided, but I cannot ascertain that one single fish has been seen after the deluge we have just experienced. Apart from the smell which it emits, the colour of the water is enough to set both man and beast against it. The river, in fact in its present state, is good for nothing but a boundary fence, and highway for barges. It contains hardly sewage enough for tillage, and considerably too much for any other purpose. It seems not a little hard, that we, who have no participation in the profits arising from its pollution, should have our river rendered thus useless and unpleasant. You will indeed confer a great boon upon us if you can do anything towards restoring it to that primitive state of purity which made it a favourite resort of salmon, and according to the old* distich insured the cleanliness of those Castleford damsels, who have now to avail themselves of a cheap train to Scarborough to perform even an annual ablution.

Your obedient servant,

(Signed) James J. B. Landon, M.A.,
Vicar of Ledsham, Yorkshire.

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* "Castleford lasses must needs be fair,
For they wash both in Calder and Aire."
Or, according to the more elegant version of Lord Houghton,—
"Castleford lasses must needs be fair,
Washed in the Calder and bathed in the Aire."
N.B.—*Fair*, it should be here observed, has no reference to the personal attractions of the ladies in question, but merely means clean, in the way we use the term when we speak of a "fair linen cloth."

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Tipped into streams, 756–7, 1249–50, 1294, 1324–34, 2381, 3016*, **3210***, TABLE, 3399*–3401*, 3523–7, 4303–4, 4575, **4613**, 4823, 5017, 5501–4, 12,671–4, 12,682, 12,687–701, 12,746–7, 12,793–6, 12,802, 12,874–5, 13,632–8, 14,127–34.
Effect of ashes tipped into streams. The bed is raised, 693, 3366–92, 3197*–8, 3203*, 3302*, 3406*, 3529–31, 4386, 4520, 4549, **4616–7**, 4942, **5422** Paper, **5736–9**, 8641–8, 11,265, 12,802–4, 12,898–901, 12,942, 13,**156**, 13,467–8, 13,515–22, 13,541–6, 13,619, 13,690, 13,736, 13,827, 13,832, 13,898–909, 14,056–7, 14,122, 14.148–51, 14,515, 15,933. Banks become irregular, 3123*, 4942. Floods are caused or increased, 3048*, 3204*, 3303*, 3537–40, 5422 Paper, 12028–31, 12,634, 13,547–9, 13,599–614. Navigation is impeded, 1334. Drains are backed up, 13,157–8, **13,599–614**, 13,627, 13,814–9, 13,833–7, 13,923–40. Water-power is decreased, **11,942**, **12,602–16**, **14,099–100**. *Secus*, the raising of the bed is due not to ashes, but to mountain débris, 12,987–8, 14,160, 14,167, but see 13,159.
The throwing in of, prohibited under the Aire and Calder Navigation Acts: 1326–34, 1871–8, 2060, 6890, 7485; but the prohibition applies only to navigation channels, not to becks, 2066–7, 7328–32, 7477–8.
Legislature should prohibit throwing of ashes into any running stream, 3391–2, 3019*, 3528, **6893–8**, 9302, **10,519–23**, **11,092**, 11,455, 11,710, 12,117, 12,622–3.

ASH-PITS, see *Privies.*

ATKINSON, Mr. (of Pontefract)
Evidence of, 16,574–626.

AUTY, Mr. E. (Messrs. J. Howgate and Sons, of Mirfield):
Evidence of, 2585–675.

B.

BAILEY, Mr. (of Skipton):
Evidence of, 15,065-89.

BAMFORD, Mr. (of Todmorden):
Evidence of, 13,046-92.

BARKER, Mr. J. (of Wakefield):
Evidence of, 1335–444.

BARTHOLOMEW, Mr. (of Leeds, Engineer to Aire and Calder Navigation):
Evidence of, 7300–468.

BATES, Mr. J. (of Dewsbury):
Evidence of, 2824–99.

BATLEY, *see* evidence of chairman of local board, 2363–2481; of late surveyor and inspector of nuisances, 2312–62; of Mr. Marriott, cotton merchant, 2482–560. Population, 2368. Rateable value, 2398. Area, 2430. Sewerage partial, 2316. Sewers not ventilated, 2324–6. Sewage passes into beck, 2316–21; 2387. Ashpits, 2328–38.

BEAUMONT, Mr. (of Elland):
Evidence of, 12,580–95.

BEHRENS, Mr. (of Bradford):
Statistics put in by, 10,808–9.

BINGLEY, *see* Evidence of Mr. Dryden, Improvement Commissioner, 13,452–522; of Mr. Sugden, worsted spinner, 14,516–596. Population 13,454; rateable value 14,350; local government 13,453–62; sewage of, goes into Aire, 13,471, 14,352–4, 14,364; waterclosets exceptional, 13,475–8; Water Supply, 14,348.

BLACKBURN, Mr. (of Brighouse):
Letter from, 5422.

BLAMIRES Mr. (of Bradford):
Evidence of, 10,232–61.

BOOTH, Mr. (of Halifax):
Evidence of, 13,150–294.

BOWDITCH, Rev. Mr. (of Wakefield):
Evidence of, 2199–2201.

BRACKEN, Mr. (of Luddenden):
Evidence of, 12,249–90.

[*Numbers* 2919–3467 *are repeated in the Evidence: when the reference is made to the numbers as used the second time, the numbers are distinguished by an asterisk.*]

BRADFORD:
Witnesses examined:
The Mayor 8630–58.
President of Chamber of Commerce, 10,435–639.
Town clerk, 8728–827.
Borough engineer, 8828–9109, 9913–5.
Manager of gasworks, 9350–462.
Mr. Jeffery, solicitor to the prosecutors of Canal Company, 9684–709.
„ Mumford, solicitor to Bradford Canal Company, 10,640–54.
„ Crowther, lessee of Bradford canal, 10,653–10,708.
„ Constable, solicitor to Mr. Stansfield, owner of Esholt Hall, 9617–83.
„ Riley, gardener at Esholt Hall, 9560–616.
„ Holmes, gamekeeper at Esholt Hall, 9505–59.
„ Godwin, stuff merchant, 8659–727.
„ Mitchell, stuff merchant, 9463–504.
„ Ingham, dyer, 9110–9251.
„ Samuel Smith, dyer, 9252–349, 10,709–749.
„ Sutcliffe, mill-owner, 9916–81.
„ F. W. Anderton, worsted spinner, 10,262–322.
„ Illingworth, spinner, 10,373–434.
„ J. W. Leather, civil engineer, 9982–10,231.
„ Blamires, soap manufacturer, 10,232–61.
„ Thompson, soap manufacturer, 9768–862.
„ Hamilton, grease manufacturer, 10,323–72.
„ Salmond, soap manufacturer, 10,750–94.
„ Slee, tanner, 9710–67.
„ Leather, vitriol maker, 9862–912.
„ France, accountant, 10,795–808.
Area 8832–3, 8906. Rateable value, 8746, 8835–6. Population, 8664, 8717, 8745, 8834. Trade, *see* evidence of Mr. Ripley, **10,435–654**, especially 10,567–72. Local Acts, 8734–40. Water Supply, 8866–99, 8915–31, and see *Water Supply*. Gasworks, 9350–462. Sewerage 8859–61, 8945–64; 8972–83, and see *Sewerage*. Sewage passes into beck, 8654, see *Sewage*. Privies, 8846–56. Waterclosets, 8845. Mortality, 8965–70. Beck receives the whole sewage of town, 7296–7, 8433–5, 8654, 8912, 9668; is encroached on by buildings 8903, 8907, 8912. Canal, fed by beck and very foul; closed by an injunction, and about to be sold, 8543, 8700, **8913–5**, 9226–36, and see Evidence of Mr. Crowther 10,655–708; of Mr. Mumford 10,640–54; of Mr. Jeffery, 9684–9709.

BRADLEY, Mr. W. (of Skipton):
Evidence of, 14,864–922.

BRADLEY, Mr. B. H. (of Skipton):
Evidence of, 15,120–204.

BRAMLEY:
Unsewered and unhealthy, 6382–9.

BRAYSHAW, Mr. (of Bradford):
Evidence of, 8630–658.

BRIGHOUSE:
Letter from Mr. Blackburn of, 13,092–3.

BRIGG, Mr. (of Keighley):
Evidence of, 13,981–14,108.

BROOK, Mr. John (of Huddersfield, registrar):
Evidence of, 2979*–3103.*

BROOKE, Mr. E. (of Huddersfield, earthenware tube manufacturer):
Evidence of, 3994–4071, 4785–4815.

BROOKE, Mr. H. (of Huddersfield, woollen manufacturer):
Evidence of, 3504–674.

BROOKE, Mr. T. (of Huddersfield, mill-owner):
Evidence of, 4816–969.

BROOKE, Mr. (of Water Fryston):
Evidence of, 16,655–87.

BUCKLEY, Mr. (of Todmorden):
Evidence of, 12,656–74.

BURGESS, Mr. (of Huddersfield):
Evidence of, 4970–5003.

BURR, Mr. (of Keighley):
Evidence of, 13,370–451.

C.

CALDER, see *Dewsbury, Halifax, Huddersfield, Todmorden, Wakefield.* Area and population of Valley, **118–119** TABLES: **10,231** TABLE No. 4.

CALVERT, Mr. (of Skipton.)
Evidence of, 14,923–15,008, 15,295–308.

CANAL, *see* evidence of Mr. Greenwood, Inspector of Canals at Huddersfield, 3272*–3336*; and *Aire and Calder Navigation.* Bradford; fed by beck, and very foul; about to be closed, as a nuisance, under an injunction, 8543,8700, **8913–5**, 9226–36; and *see* evidence of Mr. Crowther, 10,655–708; of Mr. Mumford, 10,640–54; of Mr. Jeffery, 9684–709. Canals, holding stagnant water, supplied from the rivers, become worse than the rivers, 3268*, 3272* Paper; 3287*, 3288, 4116, 8700, 8702, **8913**, 10,656–82, 11,473, 11,482–3, 11,928. Canals sometimes used as Water Supply, 3322*–36*, 3556–60, 7359–66, 14,344–5.

CANAL ASSOCIATION, Letter from, **8629–30.**

CARBIDE, filtration by, *see* evidence of Mr. Spencer, 1714–1837, 1982–2051, and *Water Supply* (Wakefield.) Cost of, to Leeds would be 20,000*l.*, 5927.

CARCASES, floating in river. See *Scavenging.*

CARTER, Mr. (of Knottingley):
Evidence of, 16,518–54.

CARTER, Mr. Alderman, of Leeds, 7000–161.

CASTLEFORD:
Witnesses examined:
Dr. Simpson, Officer of Health, 16,280–371, 16,572–3.
Mr. Jessop, surgeon, 16,200–32.
„ Wilkinson, agent to Aire and Calder Navigation Company, 16,121–99.
„ Horn, flint grinder, 15,468–570.
„ Simpson, glass bottle manufacturer, 16,372–427.
„ Hunt, manufacturing chemist, 16,428–83.
„ Heptinstall, corn miller and maltster, 15,968–16,120, 16,283–79.
„ Wilson, manager of gasworks, 16,484–517.
Population, 15,979, 16,113–5. LocalGovernment, 15,981–4. Mortality, 16,116, 16,342, 16,350, 16573. Sewerage very partial, sewers not ventilated, 16,227–30, 16,250–3, 16,233–79; sewer mouths not protected, 16,254–8; some sewers are open, 16,260. Sewage from sewers passes into river, 15,502–4, 15,986. Sewers are sometimes back-watered by floods into cottages, 16,239–44, 16,271–9, see *Sewerage*, *Sewage*. Waterclosets, nine in number, 15,988. Privies, 16,074–9, 16,293–309. See *Privies*. Water Supply, 16,063–7, 16,212–7, 16,285–91, 16,343 Paper; 16,351–4, 16,357–60, and see *Water Supply*. Gasworks, 16,484–98.

CATTLE suffer from polluted water, 1282, 3194*–5,* 5572–9, 5584, 5621–5, 5761–6, 8259, and *see* evidence of Mr. Mitchell, 7665–7732.

CHADWICK, Dr. (of Leeds):
Evidence of, 6660–776.

CHAMBERS, Mr. (of Todmorden):
Evidence of, 12,740–71.

CHARLESWORTH, Mr. (of Thornhill):
Evidence of, 3041–104.

CHEMICALS. *See* evidence of Mr. Leather, of Bradford, 9862–915; of Mr. Hunt, of Castleford, 16,428–16,483; of Mr. Holliday, of Huddersfield, 3904–93; of Mr. Hick, of Wakefield, 1926–81. Used in copperas manufacture, 1926–81; in dyeworks, 9158, 11,638, 12,087, **12,340**; in wireworks, 11,344; in paper manufacture, 12,057, 12,265; in tanning, 6450–1 Table. Chemical works at Leeds, **6659–60**, TABLE. A nuisance to the rivers, 789–90, 1273–6, 3923–9, 6601–7, 11,950–6; should be excluded from the rivers, Letter of Canal Association, 8629–30.

CHILD, Mr. (of Halifax)
Evidence of, 11,825–95.

CHILDE, Mr. (of Wakefield):
Evidence of, 1690–714.

CHOLERA in Wakefield, 31, 2141, 2146, 2156–67, 2171–89, 2199–201; at Castleford, 16,351–354.

[*Numbers* 2919–3467 *are repeated in the Evidence: when the reference is made to the numbers as used the second time, the numbers are distinguished by an asterisk.*]

CLARKE, Mr. (of Skipton):
Evidence of, 15,309–33.

CLAY, Mr. D. (of Sowerby Bridge):
Evidence of, 12,196–12,248.

CLAY, Mr. (of Rastrick):
Evidence of, 11,720–11,824.

CLOUGH, Mr. (of Huddersfield):
Evidence of, 5319–86, 5401–2.

CLOUGH, Mr. (of Keighley):
Evidence of, 14,365–454.

COCKSHOTT, Mr. W. (of Keighley):
Evidence of, 13,615–677.

COCOA-NUT FIBRE MANUFACTURE. *See* evidence of Mr. Perkin, 1544–1616; a pollution to the Calder at Wakefield, 103–5, 472–4, 2149; one firm restrained by injunction, 543–4 Paper.

COLEMAN, Mr. (of Pontefract):
Evidence of, 15,571–15,633.

COLLIERIES:
Sometimes furnish Water Supply, 10,471–6; sometimes diminish it, 16,508. Ochrey water from, see *Ochrey*.

COLNE, RIVER. *See* **3210–1 TABLE**, and generally evidence taken at Huddersfield, 2919*–5422.

CONSERVANCY, RIVER:
Necessary, to prevent pollution, 2063–4, 1490; to prevent casting in of solids, 7493, 12,018, 12,512, 12,622–3, 13,324, 13,640; to prevent encroachments, 5422 Paper, 14,779, 12,712–3; to establish protection against floodings, 12,757, 12,865–70, 12,989, 13,032.
There must be local boards to maintain a local supervision, 5088–92, 4954–5, 8799, 3575–6, 4256–9.
There must be a central authority to see that local boards do their duty to those situated lower down on the river; its jurisdiction must extend over entire length of river, and over tributaries as well as main stream, in short, over watershed, 2081, 2754, 2914, 3575–6, 4256–9, 6941, 8649–52, 11,866, 11,245–51.
Suggestions for constitution of local board:
α. The Board of Health, or ordinary local government, 5401.
β. A board consisting of persons most interested, as manufacturers, managers of water companies, borough surveyors, &c., to be elected in district, 4221–2, 4954–5, 5088–92, 5112, 5387–5400; or nominated by magistrates.
γ. An independent power appointed by central government, 67–9, 1490, 2064, 2086–9, 2119–23, 2969, 4695–700, 5506–9, 5568, 10,111–12, 13,331–3, 15,253–9, 15,730, 15,735–49.
Suggestions for constitution of central authority:
α. A board consisting of persons most interested, elected from the whole watershed, 4, 10,929–44, 10,985–91.
β. A department of supreme government, 3575–6, 11,245–51.
γ. Inspectors (like Factory Act Inspectors) appointed by supreme government, and independent therefore of local board, 2477, 2971, 4281, 4954–5, 5093, 5391, 8799, 13,330–6, Letter 13,092–3.
Assistance should be given by magistrates, 2081, 4264, 13,337–48; by borough and county police, 2074–7, 2105–6, 2478–9, 13,337–48, 14,064–7. Any persons interested should have power to prosecute, and punishment should extend to persons causing offence to be done, **8628–30** Letter. Manufacturers, members of local boards, ought not to vote on matters in which they are interested, 5401. Provisions of Highway Act might be imitated, 5411.
Expense of, to be borne by county rate, 2107–9, 3372*–4, 3761, 4969; to be made on Poor Law valuation, and to be collected by overseers of poor when they collect the poor rate, **10,968–71**, 12,757–62, 12,781–5, **12,865**, **12,890–3**, 13,325–8.
See *Legislation*.

CONSTABLE, Mr. (of Otley):
Evidence of, 9617–83.

COOPER, Mr. (of Fartown, Huddersfield):
Evidence of, 4750–84.

COPPERAS (Manufacture): *see* Evidence of Mr. Hick, of Wakefield, 1926–81.

COTTON (Manufacture): *see* Evidence of Mr. Sidgwick, of Skipton, 14,667–724; of Mr. Marriott, 2482–2560.

CRAVEN, Mr. C. (of Keighley):
Evidence of, 13,728–820.

CRAVEN, Mr. Joseph (of Keighley):
Evidence of, 13,093–149.

CRONHELM, Mr. (of Halifax):
Evidence of, 11,896–985.

CROSLAND, Mr. (of Lockwood):
Evidence of, 4500–64.

CROSSLEY, Mr. (of Halifax):
Evidence of, 12,083–124.

CROSSLEY, Mr. (of Halifax):
Evidence of, 10,992–11,144.

CROWTHER, Mr. (of Bradford):
Evidence of, 10,655–708.

CROWTHER, Mr. (of Lockwood):
Evidence of, 4565–4705.

CRUTCHLEY, Mr. (of Wakefield)
Evidence of, 1096–1151.

D.

DARWIN, Mr. (of Otley):
Evidence of, 5580–5625.

DEBRIS: From mountains, chokes the streams, 3271*–2* Paper; 3318*, 12,699; how to be intercepted, **5731–34**, 12,814–7, 12,908–10, 12,978, 15,164–9, 15,272–6.

DENT, Mr. (of Wakefield):
Evidence of, 1838–1925.

DEWHURST, Mr. (of Skipton):
Evidence of, 14,800–63.

DEWSBURY:
Witnesses examined:
Mayor, 2676–2823.
Borough Surveyor, 2202–60,
Inspectors of Nuisances, 2261–2311.
Mr. Ridgway, 2561–84.
„ Bates, 2824–99.
„ Alderman Tweedale, 2900–18.
„ Maddison, 2930–3040.
Population, 2204–5. Area, 2222. Trade, 2206. Sewerage, 2208–21, see *Sewerage*. Sewage of sewers passes into rivers, 2209, see *Sewage*. Water Supply, 2223–7, 2250–2, see *Water Supply*. Privies, 2243–5, 2253–6, 2287–94, see *Privies*. Slaughterhouses 2302–11.

DIBB, Mr. (of Wakefield):
Evidence of, 146–51.

DIXON, Mr. (of Keighley):
Evidence of, 14,597–662.

DRAINAGE:
Its effect on health, volume of river, and value of land, **10,218–31** and see *Aire Dale Drainage*.

DREDGING:
See evidence of Mr. Bartholomew, engineer to Aire and Calder Navigation, 7300–468; of Mr. Holmes, 735–830; of Mr. G. Smith, 1222–334; of Mr. Oates, 3354–467; of Mr. Wilkinson, 16,121–99. Increasing extent and cost of, 740–7, 763–5, 1224–43, 1253, 7318–33, 7348. **7487–8** Tables; material dredged up, not sand but ashes and filth, 1249–50, 1294, 3220–2, 3293, 3393–3410, **16,174–6**, **16,189**. Occasionally done by manufacturers for themselves, 6928–31.

DRESSER, Mr. (of Headingley, Leeds):
Evidence of, 8080–231.

DRYDEN, Mr. (of Bingley):
Evidence of 13,452–522.

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DYERS :
Witnesses examined :
At Bradford Mr Ingham, 9110–251.
„ Ripley, 10,435–639.
„ Samuel Smith, 9252–349, 10,709–49.
At Dewsbury, „ Auty, 2585–2675.
„ Bates, 2824–99.
„ Ellis, 2676–823.
„ Wormald, 3134–257.
At Halifax, „ Clay, 11,720–824.
„ Clay, 12,196–248.
„ Cronhelm, 11,896–985.
„ Crossley, 12,083–124.
„ Holdsworth, 11,362–493.
„ Ingham, 11,599–719.
At Huddersfield, „ Armitage, 3675–807.
„ H. Brooke, 3504–674.
„ T. Brooke, 4816–969.
„ Crowther, 4565–705.
„ Eastwood, 3379*–503.
„ Farrar, 4286–364.
„ Kenyon, 3808–903.
„ Robinson, 4365–455.
„ Robson, 5260–310.
„ Wrigley, 5004–113.
At Leeds, „ Alderman George, 6777–863.
„ Holroyd, 7923–8079.
„ Reffitt, 8468–578.
At Skipton, „ Dewhurst, 14,800–63.
At Wakefield, „ Barker, 1335–444.
„ Dent, 1838–925.
„ Goldthorpe, 1445–543.

DYES :
Kinds used, 1884–6, 2651–64, 3429*–33*. Amount used, 6789, 11,635, 12,086, 12,344, 14,825; altogether in the district perhaps 20,000 tons yearly, **10,545–52**. Process of using, 435, 10,478–9, 10,711, 14,825–63.

DYEING :
Extent of trade. *See* evidence of Mr. Ripley, **10,435–10,639**.

DYE WASTE, SOLID :
Is thrown into river, 2240, 2381–2, 2571–6, 2583, 6790, 7958, 9125–9, 12,218–20; to the great injury of the bed, 793–6; might be all kept out without hardship to manufactures, 1868, 2503–9, 2538–9, 2625–6, 2723, 2740. Its use for land may be questionable, 2713–21, 10,493; though it is occasionally bought by farmers, 8507–10; but chipped dyewoods are easily collected and burnt under boilers, 1437, 1590, 2601–2, 2722, 3036*, 3397*, 5291, 8511, 11,641, 11,993–9, 12,104, 14,810–2. Rasped dyewoods may be collected with a little trouble, and, though unfit for fuel, may be made into a spoil-heap, and so burnt, 6793, 6841–3, 7974–6, 9297, **10,495–10,505**, **11,099–11,106**, 11,643–5, 11,760–1, **12,024–6**.

DYE WASTE, LIQUID :
Volume of, 3638–43, 4290, 4579, 4889–93, 4903, 6782, **6806–7**, 6848–54, 8490–506, 9154–8, 9269–80, **12,336**, and *see* **3210–1** Table. Amount of dye in, **11,824** Letter. Cast into stream, table **3210–1**, and *passim*. Pollution from, see *Pollution*. Somewhat useful, however, as a deodorizer of sewage and other putrifying refuse, 11,701–3. Cannot be intercepted from streams, because foul water more valuable than none, 2699–700, 3171–7, 3242, 3581–3, 4240–1. Bad for purposes of irrigation, 2547, 5282–8. *Secus*, good for irrigation, 3567–8, 3658, **3696**, **3709–41**, **3769–77**, **3792**, **3820**, **3870**, 3877–83; but possibly good, because of admixture of soap, and might be injurious if soap were previously extracted, **3786–3807**; but certainly not injurious to land if run into sewers and mixed with sewage, 2820, 3807, 6830. Can with difficulty be partially purified by filtration, 1430–3, 2542–6, 2630, 3743–7, **3822–3863**, 10,507; also by settlement, 1900–3, 2446, 2628–9, **10,471**, 10,490–2, **10,729–31**, 11,183, 11,222; but settling reservoirs require space, and might become a nuisance, if the liquid waste contained oil and soap, 2701, 2710–3. Have manufactories usually space for treatment of waste products? 1438–42, 1537, 1907–12, 3131,2, 3611, 4343–7, 9148, 9201–4, 9216–24, 9322–5, 11,817. Whatever treatment is possible might, in many cases, be applied to the waste of several mills in combination, 2726–8, **3467** Paper; *Secus*, 10,491.

E.

EASTWOOD, Mr. (of Huddersfield) :
Evidence of, 3379*–3503.

ELLIS, Mr. (of Dewsbury) :
Evidence of, 2676–2823.

ELLISON, Mr. (of Knaresboro') :
Evidence of, 5771–87.

EMMOTT, Mr. (of Keighley) :
Evidence of, 13,895–974.

EXCAVATIONS :
Thrown into river, 2934*, 3122*–3*, 4085, 4408,9, 12,323, 12,764, **12,970–1**, 13,622, 13,831, 14,160; might be utilized for raising low levels, 3124*.

EXCREMENT :
Used in manufactures. Pigs' dung for cloth, 7587. Dogs' dung for leather, 7587–8, 7597–6000. Human ordure for cloth and tanning, 7590, 6581–6. Urine, 2447.

F.

FARRAR, Mr. G. (of Honley) :
Evidence of, 4286–4364.

FAWCETT, Mr. J. (of Huddersfield) :
Evidence of, 2966*–78*.

FENWICK, Mr. T. (of Leeds) :
Evidence of, 5706–5771.

FERNSIDE, Mr. (of Pontefract) :
Evidence of, 15,378–15,467.

FERRAND, Mr. W. (of St. Ives, Bingley) :
Evidence of, 5481–5579, 13,295–13,396

FIELDEN, Mr. John (of Todmorden) :
Evidence of, 12,844–870.

FIELDEN, Mr. Joshua (of Todmorden) :
Evidence of, 12,786–843.

FIELDING, Mr. (of Sowerby Bridge) :
Evidence of, 11,986–12,031.

FIELDING, Mr. R. (of Todmorden) :
Evidence of, 12,675–12,701.

FILLITER, Mr. E. (of Leeds) :
Evidence of, 5788–6084.

FILTRATION :
Of water, by Carbide, *see* evidence of Mr. Spencer 1714–1837; Mr. Filliter, 5917–5930.
Of dye liquor, 1430–3, 2542–6, 2630, 3743–7, **3822–63**, 10,507.

FISH :
Formerly abundant in rivers, now almost extinguished, 4, 85–6 Paper, 106–9, 119, 130, 548–51, 673–6, 718, 827–30, 1277, 2280–2, 2380, 3066–8, 3156–7, 3307–12, 3451–2, 6469, 7736–66, 8319, 13,687, 16,041–6; and *see* evidence of Mr. Roodhouse of Wakefield. 1067–1095.

FLAX SPINNING :
See evidence of Mr. R. Tennant, of Leeds, 6864–6999.

FLOODINGS :
About the same as formerly, 704, 1381; fewer and not so severe, 12, 143–5, 1256–7, 3080, 3411–7, 3261*, 4871, 7405, 10,001. Causes assigned; equalization of flow by construction of reservoirs, 3081, 3424–5, 3264*–6*, 4871,2, 10,002, 14,012; and more rapid passing away of water in consequence of Aire Dale Drainage, 5770 Paper No. 1, 5717–30, 5745–7, 14,898–903, 15,037–52, 15,134–8, 15,156–63, 15,173–9, 15,928–30. *Secus*, greater than formerly, 13,263–4. Recorded heights of floods, 683–6, 770–7, 3411–21, 5755–9, **13,052–92**. Particulars as to great flood of November 1866; at Wakefield, 734; at Bradford, 10,187; at Todmorden, **12,653–5**, 12,702–8, 12,728–33; at Keighley, 13,301–3, 13,732–8, 13,819, 14,095–6, 14,152, 14,163, 14,358–64, 14,392–403, 14,550–5; at Castle-

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Floodings—*cont.*
ford, 16,001–8, 16,137–43, 16,218–24; at Knottingley, 16,721–50.
(Preventible causes of):
Neglect of embankments, 3433–4, 12,712–3,**12,725–7**, 12,761–4, 12,780, 12,802, 12,946, 12,976.
Raising of bed by casting in ashes, 693, 3366–92, 3197*–8, 3203*, 3302*, 3406*, 3529–31, 4386, 4520, 4549, **4616–7**, 4942, 5422 Paper, 5736–9, 8641–8, 11,265. 12,802–4, 12,898–901, 12,942, **13,156–9**, 13,467–8, 13,515–22, 13,541–6, 13,619, 13,690, 13,736, 13,827, 13,832, 13,898–13,909, 14,056–7, 14,122, 14,148–51, 14,515, 15,933; by suffering accumulation of mountain débris, 12,987–8, 14,160, 14,167.
Improper drainage, 5515–5517, 5564, 7406. But see *Aire Dale Drainage.*
Raising of dams and cloughs, 6499–503, 12,924.
Insufficient water way, 12,780.
Permanent obstructions placed in waterway, 14,395, 402.
Diversion of stream from proper course, 12,803.
Neglect of land-owners to shut flaps of drains, 697–700, 3435–6.
Careless letting out of contents of reservoirs, 13,298.
Effects of, *see especially* evidence at Todmorden, 12,596–13,092.
On dwellings, at Todmorden, **13,014–26**, 13,642–4; at Keighley, 13,923–40, 13,968–70; at Castleford, 16,220–4; at Knottingley, 16,737.
On wells, 16,356.
On manufactories, 1383,4, 3048*–9*, 4348–50, **12, 754–6**, 12,945–7, **12,974–5, 12,991**, 13,550, 13,631, 14,173–4.
Gasworks at Knottingley suspended for a week, 16,721.
Effect of; on land, 3428–32, 5515, 12,702–12,708, **12,754**, 13,297, 13,311; on banks, 1258–60; on bed of river, 1264–70, 12,641–5, 13,027–9, 16,157–9.
Authority required to make proper provision against, 12,757, 12,865–70, 12,989, 13,032. The benefits of proper provision would be many times the value of the outlay, **12,754–6, 12,974–5, 12,991**.

Fowler, Mr. A. M. (of Leeds):
Evidence of, 6172–6260.

Fowler, Mr. Jas. (of Wakefield):
Evidence of, 457–544.

France, Mr. (of Bradford):
Evidence of, 10,795–10,808.

Fulling:
See evidence of Mr. Tattersfield, 3258–353, 3244–53.

G.

Garside, Mr. Alderman (of Leeds):
Evidence of, 8315–8463.

Gas:
Managers of gasworks examined:
At Bradford, Mr. Swallow, 9350–462.
„ Castleford, Mr. Wilson, 16,484–502.
„ Halifax, Mr. Malam, 12,534–12,579.
„ Huddersfield, Mr. Burgess, 4970–5003.
„ Keighley, Mr. Craven, 13,728–13,820.
„ Leeds, Mr. C. Smith, 7767–876.
Mr. Arnott, 8579–629.
Waste products are all saleable, none thrown into river from great gasworks. *Secus* at private gasworks, 3255*–9 14,569, and complaints still made against Halifax works, 11,945–9, 12,504–6. Accumulation of lime a nuisance at Leeds, 6553–62, 7773–9, 7803–7, 7833–40; at Bradford, 9364–6, 9389–92.

George, Mr. Alderman (of Leeds):
Evidence of, 6777–863.

Godwin, Mr. (of Bradford):
Evidence of, 8659–727.

Goldthorpe, Mr. (of Wakefield):
Evidence of, 1445–1543.

Goodall, Mr. T. (of Dewsbury):
Evidence of, 2261–311.

Gott, Mr. (of Bradford):
Evidence of, 8828–9109, 9913–5.

Graham, Captain (of Huddersfield):
Evidence of, 4072–4146.

Graham, Mr. (of Keighley):
Evidence of, 14,763–99.

Grease Extractors:
Witnesses examined,
At Bradford, Mr. Blamires, 10,232–61.
Mr. Hamilton, 10,323–72.
Mr. Salmond, 10,750–94.
Mr. Thompson, 9768–862.
„ Huddersfield, Mr. Seed, 5114–51.
„ Keighley, Mr. Townend, 14,215–63.
„ Wakefield, Mr. Teall, 316–456,

Grease Extraction:
From waste soapsuds,
1. Process.
2. Result.
3. Extent of its application.
4. Causes of its limited application.

1. Process commenced 20 years ago; before that time the valuable grease was lost and polluted the river, 326. Process described, 320–3, 336–42, 431, 9814. Acid used as a precipitate, 5143–50; as little acid used as posible, 431, 9804–5; perhaps 15 lbs. of acid to 1,100 lbs. of water, 9795–800, 10,332–4. Two modes, one hot, which by use of steam extracts a larger quantity of grease in a shorter time, a patent process, 335, 5132–40; the other, the cold process, not patented, 3317. Process, if not properly attended to, may cause smell and nuisance, 404–7, 596, 6578. Some manufacturers operate on their own soapsuds, 411, 4191–4, 11,060, 14,220–36; others let out their soapsuds to contractors, and usually provide premises and steam, 347, 402. In some cases the contractor collects the soapsuds of several factories into premises of his own, and there operates upon them, 334, 1531–4. The contractor pays either a lump annual sum, or so much for the quantity of soap used at factory or recovered as finished grease, 347, 9218, 9838–9, 10,277, 10,317, 10,405–11.

2. Results, &c. Grease is recovered, convertible into stearine and cloth-oil worth from 18*l.* to 20*l.* per ton, 343, 394, 5120. Estimate of amount of soap used, 1356, 1511–2, 11,839, 12,101, **12,337**, 14,072, 14,216, 14,471. Proportion of soap to volume of water, **11,824** Letter; amount recovered perhaps 15 cwt. out of 12 packs of soap, each of 256 lbs., 10,351, 4915–31, 9842, 9851. Lump sums paid annually by contractors to manufacturers, from a few pounds up to 900*l.*, and in one case 3,000*l.*, 349, **411**, 439–41. Proportion paid upon soap consumed varies from $\frac{1}{30}$th up to $\frac{1}{2}$th, **4915–31**, 9218, 9838–9, 9842, 9851, 10,277, 10,317, 10,405–11, and the manufacturer provides premises and steam, 347, 402.
β. A residuum, bought by farmers as (not very valuable) manure; 344, 10,335, 10,359, 11,064–6.
γ. Indigo (when used) is recovered, 380–6, 420–5.
δ. Effluent water is much improved, 351, 378, 429, 9804; but still dirty, 2703–4, 5051–2, 7221, 9862. 10,341–2, 10,280, 14,500–1; is not bad for irrigation, 14,080–90; if subsequently filtered, becomes quite clear and fit for dyeing, 14,241–50, 14,304–7, 14,313–5.

3. Extent of application. Mr. Teall has 120 establishments, 352, and recovers weekly 50 tons of grease; other contractors recover 50 more, 391–2; altogether perhaps, 4,000*l.* worth of grease is obtained, 399. Instances where process is used, 1398, 2620, 2702, 3163, 5046–56, 2382, 7199–231, 9873, 10,275, 10,590, 11,060, 11,216, 11,381, 11,920, 12,223, 12,363, 14,218, 14,474.

4. Causes of its limited application: α. Many firms, for the sake of small profit, will not take trouble to work process or admit strangers on the premises for the purpose; in very few cases, where factories are very small, the process might not pay, 354–7, 363. The soapsuds of hundreds of small factories are yet untouched, 355–9; instances, 1454, 1509–10, 1906, 3764–6, 5273–8, 9205–13, 11,623, 11,747–8, 11,845–9, 12,102. No hardship to make process compulsory on all, at least wherever it would involve no loss, 365–7, 1402–5, 1522, 3168–9, 9214–5, 10,592–4, 14,304–5.

β. Profit comes only from operating upon richest part of soapsuds; Mr. Teall, when authorized to take all soapsuds, lets the thinner part pass, unoperated

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GREASE EXTRACTION—*cont.*
upon, into the river, 409, 1358–9, 1394, 1402, 3193–6, 3227, 3280–1, 3332–8, **4660**, **4664**, 4910, 7239–42. But the purification of moderately rich soapsuds would cost nothing, and of thin soapsuds very little, 1406–8, 364, 11,848. A small tax on manufacturers would be no hardship, and be more than compensated to them by pure water, 3585–6, 6825–8, **6836–40**, **6993–5**, 8525–30, **9328–30**, **11,131–40**, 13,362.

GREENWOOD, Mr. E. (of Huddersfield):
Evidence of, 3272*–3336*.

GUNDILL, Mr. (of Pontefract):
Evidence of, 15,827–70.

H.

HAIGH, Mr. J. (of Honley):
Evidence of, 4456–99.

HALIFAX:
Witnesses examined:
The Mayor, Mr. Shaw, 12,331–412.
Town Clerk, Mr. Norris, 10,838–991.
Borough Engineer, Mr. Richardson, 11,255–82, 11,494–598.
Chairman of Sanitary Committee, Mr. Alderman Wightman, M.D., 10,809–37
Sanitary Inspector, Mr. Magson, 12,456–533.
Dr. Alexander, 12,413–55.
Manager of Gasworks, Mr. Malam, 12,534–79.
Colonel Akroyd, M.P., 11,145–254.
Mr. John Crossley, 10,992–11,144.
„ Child, worsted manufacturer, 11,825–95.
„ Holdsworth, do. 11,362–493.
„ Morris, do. 12,291–330.
„ Beaumont, woollen manufacturer, 12,580–12,595.
„ Clay, do. 11,720–824.
„ D. Clay, do. 12,196–248.
„ Cronhelm, do. 11,896–985.
„ Rawson, do. 12,125–95.
„ Bracken, paper maker, 12,249–90.
„ Hastings, do. 12,032–82*a*.
„ Crossley, dyer, 12,083–124.
„ Ingham, dyer, 11,599–719.
„ Fielding, dyewood grinder, 11,986–12,031.
„ Smith, wire manufacturer, 11,283–361.
Area, 10,841–6. Population, 10,848–50, 12,418. Local Government, 10,843. Rateable value, 10,851–2. Mortality, 10,814, 10,818, 10,824–7, 12,419, 12,435. Sewerage, 10,817, 10,843, 11,513–61; sewers unventilated, 10,832–6, **11,526–31**, 11,556, and see *Sewerage*. Sewage passes into beck, 10,829, **10,843**, 10,901–10, and see *Sewage*. Privies, 10,920–7, 11,596–8, 12,451–5, 12,458, and see *Privies*. Waterclosets, 960 in number, 10,837. Water-Supply in hands of Corporation and good, 10,815; *See* evidence of Mr. Norris, 10,853–10,900, and *Water Supply*.

HAMERTON, Mr. (of Todmorden):
Evidence of, 12,772–785.

HAMILTON, Mr. (of Bradford):
Evidence of, 10,323–72.

HARE, Mr. C. (of Huddersfield):
Evidence of, 5152–214.

HARTLEY, Mr. (of Pontefract):
Evidence of, 15,871–967.

HATTERSLEY, Mr. (of Keighley):
Evidence of, 14,109–78.

HASTINGS, Mr. (of Stainland):
Evidence of, 12,032–82a.

HEBBLE:
volume, 11,495–6, 11,505, see *Halifax*.

HEELIS, Mr. (of Skipton):
Evidence of, 14,712–24.

HEPTINSTALL, Mr. (of Castleford):
Evidence of, 15,968–16,120. 16,233–79.

HICK, Mr. M. (of Wakefield):
Evidence of, 1926–81.

HIGGINS, Mr. J. (of Leeds):
Evidence of, 8232–314.

HIRST, Mr. (of Leeds):
Evidence of, 7877–922.

HOBSON, Mr. J. (of Huddersfield):
Evidence of, 5403–22.

HOLDSWORTH, Mr. Alderman, (of Wakefield):
Evidence of, 544–608.

HOLDSWORTH, Mr. W. I. (of Halifax):
Evidence of, 11,362–493.

HOLLIDAY, Mr. R. (of Huddersfield):
Evidence of, 4706–49.

HOLMES, Mr. W. (of Wakefield):
Evidence of, 735–830.

HOLMES, Mr. J. (of Bradford):
Evidence of, 9505–59.

HOLROYD, Mr. (of Leeds):
Evidence of, 7923–8079.

HOPKINSON, Mr. J. (of Huddersfield):
Evidence of, 4706–49.

HORN, Mr. (of Castleford):
Evidence of, 15,468–570.

HORNER, Mr. (of Skipton):
Evidence of, 15,090–119.

HUDDERSFIELD:
Witnesses examined.
Chairman of Improvement Commissioners, Mr. Turner, 2919*–65*.
Surveyor to ditto, Mr. Abbey, 3104*–211*.
Chairman to Drainage Committee, Mr. Fawcett, 2966*–78.
Registrar of Mortality, Mr. Brook, 2979*–3103*.
Inspector of Nuisances, Mr. Thornton, 3211*–72.
Manager of Gasworks, Mr. Burgess, 4970–5003.
Manager of Waterworks, Mr. Hare, 5152–214.
Clerk to Local Board of Mold Green, Mr. Mills, 5311–8.
President of Chamber of Commerce, Mr. Mellor, 4147–285, 5387–400.
Mr. Eastwood, dyer, 3379*–503.
„ Farrar, do. 4286–364.
„ Robinson. do. 4365–455.
„ Robson, do. 5260–310.
„ Armitage, woollen manufacturer, 3675–807.
„ Henry Brooke, do. 3504–674.
„ Thomas Brooke, do. 4816–969.
„ Crosland, do. 4500–64.
„ Crowther, do. 4565–705.
„ Kenyon, do. 3808–903.
„ Wrigley, do. 5004–113.
„ Jones, land surveyor, 3337*–78*.
Capt. Graham, agent to Sir J. Ramsden, 4072–146.
Mr. Seed, grease extractor, 5114–51.
„ Haigh, colliery proprietor, 4456–99.
„ Tinker, do. 5215–59.
„ Holliday, chemical manufacturer, 3904–93.
„ Brook, sanitary pipe manufacturer, 3994–4071.
„ Hopkinson, civil engineer, 4706–49.
„ Cooper, labourer, 4750–84.
„ Clough, solicitor, 5319–86, 5401–2.
„ Hobson, newspaper editor, 5403–22.
Population, 2922*, 2901*–84, 3084*. Area, 2924*. Rateable value, 2926*. Mortality, 2930*, and *see* evidence of Mr. Brook, 2979*–3010. Health and sanitary arrangements, 4118–35, and *see* evidence of Mr. Thornton, inspector of nuisances, 3271*–72. Sewerage, 2927*; sewers not ventilated, 3124*–5*. 3168*–72. Sewage, 2927*–9, 3124, 3271*. Privies cleansed by Commissioners, 3220*–28. Water Supply, 3561–5, 5152–214, and see *Water Supply*. Topography of district, 3110*–21. Trade of district, *see* evidence of Mr. Mellor, 4147–285. Pollution of rivers from, *see* Papers by Mr. Thornton, **3271***–**2**; by Mr. Abbey, **3210***–**1**

HUNT, Mr. (of Castleford):
Evidence of, 16,428–83.

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I.

ILLINGWORTH, Mr. (of Bradford):
Evidence of, 10,373–434.

INDIGO:
amount used, 1363. Proportion lost in dyeing operation, 1365–70. Not recoverable from spent vats, 416–8. Recoverable from soapsuds, 380–5, 419–25.

INGHAM, Mr. (of Bradford):
Evidence of, 9110–251.

INGHAM, Mr. (of Halifax):
Evidence of, 11,599–719.

J.

JEFFERY, Mr. (of Bradford):
Evidence of, 9684–709.

JESSOP, Mr. (of Castleford):
Evidence of, 16,200–32.

JOHNSON, Mr. J. (of Wakefield):
Evidence of, 152–282.

JONES, Mr. (of Huddersfield):
Evidence of, 3337*–78*.

JUBB, Mr. (of Batley):
Evidence of, 2363–481.

K.

KEIGHLEY:
Witnesses examined.
Chairman of Local Board, Mr. J.Craven, 13,093–149.
Consulting Engineer of do. Mr. Booth, 13,150–294.
Clerk to do. Mr. Burr, 13,370–451, 13,975–80.
Surveyor to do. Mr. Sharp, 13,821–94.
Inspector of Nuisances, Mr. Emmott, 13,895–974.
Superintendent of Gasworks, Mr. Craven, 13,728–820.
Mr. Ferrand, 13,295–369.
„ Dryden, 13,452–522.
„ Milligan, surgeon, 13,678–727.
„ Dixon, „ 14,597–621.
„ Hattersley, machine-maker, 14,109–78.
„ W. Smith, do. 13,523–614.
„ Cockshott, fellmonger, 13,615–77.
„ Brigg, worsted manufacturer, 13,981–14,108.
„ Clough, do. 14,365–454.
„ Laycock, do. 14,330–64.
„ Townend, do. 14,179–329.
„ Marriner, do. 14,543–515.
„ Sugden, do. 14,516–96.
„ Graham, do. 14,763–99.
Population, 13,094–5. Area, 13,252–60. Geological character of district, 13,269–74. Local Government. 13,374–415. Sewerage, 13,108; sewers insufficiently ventilated, 13,848–66, 14,780–7. Sewage passes into Aire, 5519–21, 13,109, 13,877–9. Privies, in case of neglect, are cleansed by Local Board, 13,147–8, 13,870–6, 14,777–9. Water Supply, 13,110–19, 13,211–51, and see *Water Supply*.

KENYON, Mr. (of Huddersfield):
Evidence of, 3808–903.

KNOTTINGLEY:
Witnesses examined.
Mr. Carter, brewer, 16,518–54.
Mr. Worfolk, shipbuilder, 16,688–750.
Population, 5,000, 16,705. Local Government Act, only nominally adopted, 16,361, 16,706–12. Sewerage very imperfect, 16,361. Sewage passes into river, 16,362. Water Supply, partly from wells liable to pollution, 16,356–60; partly from canal which has received Pontefract sewage and other pollutions, 16,545–7, 16,644–7, 16,721.

L.

LAYCOCK, Mr. (of Keighley):
Evidence of, 14,330–64.

LANDON, Rev. James J. B. (of Ledsham Vicarage, South Milford):
Letter from, 16,750.

LAW, as to pollution when amounting to public nuisance, difficult to put in force, 1036–45, 5681, **8770–2, 10,910**, 11,791–3: As to pollution, which is injurious to individual rights of property, 9658–966; difficult to put in force, 1046–7, 9637–40, 12,013–4; invidious as setting neighbour against neighbour, 3024*–5*, **3671**, 4088–93, 4234–6, 12,624–5, 13,361, **15,722–6**; unsatisfactory, as giving vested rights to individuals to pollute the river, whilst others are doing their best to keep it clean, 11,086, 14,311–3; and see *Litigation*.

LEAD MINES:
Pollution from, 8144–77.

LEATHER, Mr. G. H. (of Bradford):
Evidence of, 9862–912.

LEATHER, Mr. J. W. (of Leeds):
Evidence, 9982–10,232.

LEEDS:
Witnesses examined.
Mayor, Mr. Oxley, 5423–80.
Town Clerk, Mr. Smith, 5626–705.
Borough surveyor, Mr. Fowler, 6172–260.
Inspector of Nuisances, Mr. Swale, 6506–660.
Officer of Health, Dr. Robinson, 6085–6171.
Mr. Smith, surgeon, 7733–66.
Dr. Chadwick, physician, 6660–776.
Chairman of Waterworks Committee, Mr. Alderman Carter, 7000–161.
Mr. Fenwick, surveyor, 5706–70.
„ Ellison, 5771–87.
„ Filliter, Consulting Engineer, 5788–6084.
„ Dresser, civil engineer, 8080–8231.
„ Smith, manager of gasworks, 7767–876.
„ Arnott, manager of new gasworks, 8579–629.
„ Bartholomew, engineer to Aire and Calder Navigation Company, 7300–468.
„ Wilson, secretary to do., 7468–505.
„ Mitchell, veterinary surgeon, 7665–7732.
„ Higgins, Cattle Plague Inspector, 8232–314.
„ Ferrand, (of Bingley), 5481–5579.
„ Darwin, (of Otley), 5580–5625.
„ Pollard, agent to Sir John Lowther, 6451–505.
Secretary to Chamber of Commerce, Mr. Hirst, 7877–922.
Mr. Alderman George, dyer, 6777–863.
„ Holroyd, do. 7923–8079.
„ Reffitt, do. 8464–578.
„ Alderman Yewdall, cloth manufacturer, 7163–399.
„ R. Nickols, tanner, 6261–451.
„ Alderman Tatham, skin-dresser, 7506–664.
„ R. Tennant, flax spinner, 6864–999.
„ Alderman Garside, colliery owner, 8315–463.
Population, 228,000 persons, 6182; increase, 6004–12; 7113–7, 6183–6. Area, 6177. Rateable value, 6185. Local government. 5627, 6178–81. Mortality, 6093–9, 6165, **7112**, 6132. Has 1,000 cellar dwellings, 6121. Water Supply, 5436–9, 5649–57, **5833–66**, 5891–5904, **5965–6055**, 6072–84; and see *Water Supply*. Sewerage, extent of, 6188–9; partial, 6764–6; sewers not ventilated, 7019, 8112–37, 8337–45; nor protected by flap-valves, 7022–6; and *see* evidence of Mr. Leather, **10,005–11**. Sewage outlet, 806, 819, **5583–6**, 5620–1, 5867–70, 5887–9, 6462–3, 6504, 6719, **7670–6, 7704–11, 8087–91**, 8098–102, 8112–7. Pollution extends below Castleford, 810–15, 8103–7, 15,487, 16,153–6; solid matter obstructs navigable channel at Castleford, 16,176, 16,191. Possibility of sewage irrigation below town, 5766, 7076; two areas, one of 10,000 acres, accessible by gravitation, the other of 5,000 acres free from residential property, but not available except with pumping, 5936–41; volume to be pumped, 10,000,000 gallons daily, 5942–53; cost of pumping, 2,300*l.* per annum, **5940–1, 5953–4**; less than present cost of cleansing privies, 7124–6, 8448–54; would be more than recouped by increase of value of land from irrigation, 5955–62. Privies, 12,000 altogether, of which 1,000 are under dwellings, 6121–3, 6514–25, 6659–60, Paper; emptied by corporation at a gross cost of 6,000*l.* to

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LEEDS—*cont.*

7,000*l.* per annum; and a net loss of from 2,200*l.* to 4,000*l.* 5691–5, 6526, 6538, **6646–8**, 7046–53, 8448–54. Cleansing process a nuisance; the state of Leeds from 10 o'clock at night till about 4 in the morning, something fearful, 6527–30. Becks polluted, 5669–71, 5800–2, 6089–90, 6194–207, 6225–8, **7079**, **7627**, **7746–9**, 8430–1; occasionally, not systematically, cleansed by corporation, 6228; to be improved under recent statute, 6233–4, *see* Paper by Mr. Fowler, 6260–1. Trades in cloth, iron, flax, tanning, 5630, 6056; *see* Evidence of Mr. Hirst, secretary of the Chamber of Commerce, 7877–922. Manufactories on river, *see* Table put in by Mr. Fowler, 6260–1; **6659** Paper.

LEGISLATION FOR RIVERS:

Necessary, 1488, 1967, 2059, 2099, 2470, 2475, 2522, 2745–7, 2751, 2890–3, 2913–4, 2937*, 2964–5, 3178–88, 3574, 4092, 4278, 4352, 4704–5, 5407, 7082, 9638, 10,110, 10,544, 10,929, 12,846–7, 12,885, 13,323, **13,358–62**, 14,298, **16,191**, 16,410; voluntary combination to prevent pollution has been tried and failed, 11,086–90, **12,009–13**, **12,031**, 12,820–6.

Caution requisite as to; manufacture is bread to the people, 2932,* **5440**; value of manufacturing interests, **10,452–65**, 11,128. Competition, both home and foreign, 5075, 8051, 10,448–50.

Must be compulsory, not permissive, 142, 2059, 2064, 2086, 2472, 2752, 2893, 3178–80, 3184–5, 2937*–8*, 3575, 3610, 4278, 4284, 5088, 5451–6, 6936–7, 8685, 12,013.

Must extend to whole district, 1523–4, 7082, 8651, 8797; to all rivers, 1491, 1523, 2064, 2098, 2104, 2123, 4232, 5068–9, 5096, 5456–7, 7081–2, 8711, 8797, 8820, 9498, 10,823, 10,983.

Should prohibit casting in of solid refuse, 2431–2, 2740–5, 2751, 2935*–6*, 3415*–7*, 4360, 4550–4, 4604, 8390, **8629–30** letter, **11,086**, 11,424, 11,802–3, 11,885, 12,016–19, 12,304, 12,510, 12,757, 12,902–7, 13,323.

Should prohibit casting in of sewage, 2061–4, 2081, 8647–52.

Should require grease to be extracted from soapsuds, 365–7, 1402–5, 1522, 3168–9, 9214–5, 10,592–4, 14,304–5.

With regard to other liquid pollution, should compel purification within reasonable limits. A small expense to each manufacturer would be no burden, because (*a*) It would be the same for all, and additional cost of manufacture would be recompensed by extra price charged to the public for manufactured article, 2064, 2748–50, 6409–10, 11,130, 12,848, 14,171–6, 14,411–18. (*β*) The expense would be more than compensated by gain of pure water, 3585–6, 6825–8, **6836–40**, 6993–5, 8565–30, **9328–30**, **11,131–140**, 13,362. To a large manufacturer 200*l.* per annum would be a trifling tax, 9328–30.

See *Conservancy, Law, Litigation, Pollution, Sewage, Solid Refuse.*

LIME:

At tanneries carted away, 1590, 1628, 6341. Accumulated at gasworks so as to be occasionally a nuisance, 1998–9.

LITIGATION:

On account of river pollution, 2391–7, 2510, 3428, 3696, 3708, 3822, 6303, 8697, 9118, 9642, **9933–9**, **9953–4**, 10,909, 11,775–84, 12,013; as to Bradford canal, *see* Evidence of Mr. Crowther, 10,655–708, Mr. Jeffery, 9684–709; Mr. Mumford, 10,640–54.

On account of casting in solid refuse, 3666–71, 4408, 5542, 11,086, 11,950–6, 12,609–616, 13,430–45.

On account of floodings caused by abuse, 12,778.

On account of flushing out reservoirs, 14,265–88.

LODGING HOUSES:

See evidence of Mr. Clough of Huddersfield, 5319–86.

LORD, Mr. E. (of Todmorden):
Evidence of, 12,962–13,000.

LORD, Mr. Josiah (of Todmorden):
Evidence of, 12,894–935.

LUMB, Mr. F. (of Wakefield):
Evidence of, 1030–66.

LYNAM, Mr. E. (of Wakefield):
Evidence of, 609–665.

M.

MADDISON, Mr. (of Dewsbury):
Evidence of, 2930–3040.

MAGSON, Mr. (of Halifax).
Evidence of, 12,456–533.

MALAM, Mr. (of Halifax):
Evidence of, 12,534–79.

MALTSTERS:

Witnesses examined.

At Wakefield, Mr. Charlesworth, 3052–6.
„ Skipton, Mr. Scott, 14,725–62.
„ Pontefract, Mr. Carter, 16,518–54.

Pollution of river by, 100–2, 15,560–70, 16,103–4, 3086–99; refuse hops and grains ought to be sold for manure, not cast into river, 16,553–4; rinsings of barrels would be useful in irrigation, 16,563; are now cast into river, 16,533–4, 16,548–52, 16,562.

MANURE:

Deposits of, a nuisance, **5312** Paper.

MARRINER, Mr. (of Keighley):
Evidence of, 14,455–515.

MARRIOTT, Mr. (of Batley):
Evidence of, 2482–560.

MARSDEN, Mr. (of Skipton):
Evidence of, 15,009–64.

MCGOWEN, Mr. (of Bradford):
Evidence of, 8728–827.

MEDICAL EVIDENCE:

At Castleford, Mr. Jessop, 16,200–32.
„ Halifax, Dr. Wightman, 10,809–37.
„ „ Alexander, 12,413–55.
„ Keighley, Mr. Milligan, 13,678–727.
„ Leeds, Dr. Robinson, 6085–171.
„ „ Chadwick, 6660–776.
„ Mr. Smith, 7733–66.
„ Pontefract, Dr. Atkinson, 16,574–26.
„ „ Muscroft, 16,627–54.
„ „ Simpson, 16,280–371, 16,572–3.
„ Wakefield, Mr. Fowler, 457–544.
„ Dr. Holdsworth, 544–608.
„ Mr. Milner, 2124–70.
„ „ Statter, 1152–221.
„ Dr. Wade, 283–315.
„ „ Wright, 2171–98.

MELLOR, Mr. (of Huddersfield):
Evidence of, 4147–285, 5387–400.

MILLIGAN, Mr. (of Keighley):
Evidence of, 13,678–727.

MILNER, Mr. (of Wakefield):
Evidence of, 2124–70.

MILLS, Mr. C. (of Huddersfield):
Evidence of, 5311–18.

MIRFIELD:
See evidence of Mr. Auty, 2585–675.

MITCHELL, Mr. (of Leeds):
Evidence of, 7665–732.

MITCHELL, Mr. (of Bradford):
Evidence of, 9463–504.

MOLD GREEN: **5312** Paper.

MORGAN, Mr. (of Wakefield):
Evidence of, 86–118.

MORRIS, Mr. (of Sowerby Bridge):
Evidence of, 12,291–330.

MOULE'S:
Dry earth-closets, 5590–93.

MOXON, Mr. (of Pontefract):
Evidence of, 16,555–71.

MUMFORD, Mr. (of Bradford):
Evidence of, 10,640–54.

MUSCROFT, Dr. (of Pontefract):
Evidence of, 16,627–54.

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N.

NICKOLS, Mr. (of Leeds):
Evidence of, 6261–450.

NICOLSON, Mr. (of Skipton):
Evidence of, 15,205–94.

NORRIS, Mr. (of Halifax):
Evidence of, 10,838–991.

NORTH BECK (near Keighley):
13,185–7, 13,194–201, 13,910.

O.

OATES, Mr. (of Dewsbury):
Evidence of, 3354–467.

OCHREY: Water from mines. *See* evidence of,
Mr. Brook, 4785–815.
„ Haigh, 4456–99.
„ Tinker, 5215–59.
A very injurious form of pollution to rivers, 3003–40, 3884–5, 4369, 4417–22, 4596, **4630–1**, 4933–4, 5040–5, 12,849–57; might be kept out by walling up of dayholes, 4785, 4795. Objections to walling up dayholes; water would accumulate and burst the barrier, and then ochre would do more mischief than if let out by degrees, 5234; or water, if securely pent up, would be lost to streams and mills, 5234–7. Ochre would deposit, if water led to settling reservoirs, and the deposit would be saleable, 4795–815, 5253–5.

OAKES, Mr. (of Wakefield):
Evidence of, 119–145.

OLDROYD, Mr. (of Thornhill):
Evidence of, 2919–29.

ORMEROD, Mr. (of Todmorden):
Evidence of, 12,871–893.

OXLEY, Mr. (of Leeds):
Evidence of, 5423–80.

P.

PAPER: Manufacture. *See* evidence of Mr. Hastings, 12,032–82a; Mr. Bracken, 12,249–90.

PERKIN, Mr. G. (of Wakefield):
Evidence of, 1544–616.

POLLARD, Mr. (of Leeds):
Evidence of, 6451–505.

POLLUTION.
I. Causes.
II. Extent.
III. Effects.
IV. Law concerning.
V. Legislation.
VI. Modes of prevention.

I. Causes.
From sewage. Of Batley, 2316, 2388. Bingley, 13,471, 14,352–4, 14,364. Bradford, 8654. Castleford, 15,502–4, 16,235–6. Dewsbury, 2209. Halifax, 10,829, 10,843, **10,901–10**, 11,502–5. Harrogate, 5771–87. Honley, 4436. Huddersfield, 2927*–9*, 3124.* Keighley, 5519–21, 13,109, 13,877–9. Knottingley, 16,362. Leeds, 806–15, 5889, 8103–7, 15,847, 16,153–6, 819, 5583–6, 5620–1, 5887, 6462–3, 6504, 6719, **7670–6**, **7704–11**, 8087–91, 8098–102, 8112–7, 5584, 5621–5, 5761–5, 7680–2, 8259, 5942, 6484, **16,176**, 16,191. Lockwood, 4607. Mold Green, 5312 Paper. Pontefract, 15,348–57, 16,714–5, 15,368–77, 15,461–7, 15,708–21, 16,540–5, 16,644–7. Wakefield, 85-6 Paper, 98, 111, 253–8, 260–8, 561–2, 618, 2133, 270–3, 563, 618, and *see Sewage*.
From Privies, &c., of manufactories, 1372–5, 4169–74, **6260–1** Table, 6574, 6924–5, 7550, 10,283–5, 11,297–300, **12,886–9**, 14,140–5, and *see Privies*.
From Night-soil tipped in, 3288*–91*.
From Carcases thrown in, 50, 679–82, 1297–1302, **5643–4**, 677–8, 707–12, 754–5, 1244, 2284–5, 2413. 3072, 3464–7, 5509–11, 5586, **6539–44**, 6720, 6944–50, 7196–8, 15,119, 16,031–9, 16,132–6.
From manufacturing refuse:
Of chemical works, 789–90, 1273–6, 3923–9, 6601–7, 11,950–6, and *see Chemicals*.
Of Cocoa-nut Fibre works, **543–4**, Paper 103–5, 472–4, 1544–1616, 2149, 2170 Paper.
Of Dyeworks universal, 3210–1 Table and *passim*. See also *Dye Waste Liquid*, and *Grease Extraction*.
Of Malthouses, 100–2, 3086–99, 15,560–70, 16,103–4, 16,533–4, 16,548–54, 16,562–3.
Of Paper Mills, 12,032-82a, 12,249–90.
Of Tan Yards, 5634, 6281, 7526, 8524, 14,291–3, and *see Tanning*.
Of Wireworks, 11,344, 11,283–361.
Of Wool-dressing, greasy soapsuds, see *Grease Extraction, Wool Manufacture*.
From Ochrey water of mines, 3003–40, 3884–5, 4369, 4417–22, **4630–1**, 4933–4, 5040–5, 12,849–57.

II. Extent.
Present state of streams as compared with former state; of Aire and its tributaries, near Bradford, 8657, 8662, 8727, 10,087–91, 10,302–7, 8913, 9476–89, 9507–25, 9560–78, 9698, 9941, 10,000, 10,303–7, 10,767–79, 10,785–7. Near Castleford, 15,491, 15,527, 15,544–9, 16,009–15, 16,030, 16,046–52, 16,125–9, 16,378, 16,686. Near Keighley, 13,155. Near Knottingley, 16,693–704, 16,721. Near Leeds, 5428–30, 5485–8, 5497–8, 6087, **6260–1** Tables, **6462**, 6637–40, **6664–5**, 7170–9, **7670–6**, 8084–6. Of Calder and tributaries, near Dewsbury, 2278–82, 2378–9, 2487, 2565–70, 2604, 2682, 2688, 2856, 2906–9, 2917–8, 3048, 3156, 3263–79, 3358–63. Near Halifax, 10,901–2, 11,265, 11,390, 12,436–41, 12,450, 11,824, **12,595**, 12,010–2. Near Huddersfield, 2961*, 2976*–8*, 3012–5*, **3210–1** Paper, **3271*** Paper, 3350*, 3906–7, 4541, 4574, 4832. Near Wakefield, **85–86** Paper, 106, 119, 121, 130, 281, **543–4** Paper, 673–6, 747, 1034, 1271, 1339–46, 1844, 1861, 1965–6, 2053, 2126.
Smell, 119, 248, 604, 724–8, 783–8, 1246, 1389–93, 1967, 2053, 5312 Paper, 5434, 6462, 6719–20, 6462–3, **6943**, **7672**, 7704, 9575–7, 10,302–7, 11,397–400, 12,012, 12,082, 12,450, 14,696–7.

III. Effects—
1. On health, 120, 248–9, 254–5, 525–7, **543–4** Paper, 3994–4004, 6166–7, 6720, 12,442, 13,483-90, 13,504–14, 13,877–82, 16,046–52.
2. On the poor, spoils their natural water supply, compels them either to buy water, 3189*–93*, 4756–62, or to drink it impure, 5557, **16,351-60**, 16,721.
3. On riparian property and owners of cattle, 2055, 3194*–5*, 3369*–71*, 4078–81, 5572–9, 5584, 5621–5, 5761–6, 7680–2, and *see* evidence of Mr. Mitchell, 7665–732, 8259.
4. Upon manufactures:
Pure water requisite for manufactures, 1342–6, 1352–4, 2681, 7179–80, and *passim*. In some parts water of river and becks still used for washing, 1342, 1846; for flax works, 6878; and for dyeing, 1342, 1846, 4157–8, 4572. If water a little polluted, palliatives possible, filtration, 3060–1, chemical appliances, 6785–7, 8554–8, **2860–71**, involving additional cost of 33 per cent. As pollution increases, finer and lighter colours have to be given up by dyers, 1341–6, 1409–15, 1848–52, 1856, 2592, 3079*–81*, 3265, **8475–84**, 8566, 12,114; then water becomes altogether unfit for dyeing, 3412*, 3956, 4389, 4833, 7944–5; manufacturers have either to move their works higher up the stream, **124–7**, **1345**; or to becks, 2732; or to another district, 2517–8; or to procure an independent supply either from canal, or wells, or private reservoirs, or public waterworks. This generally the case in Aire and Calder basin, 2511, 3124*, 11,464, and *passim*. Cost of water pumped from wells, 9135–7, 9160–7, **9193–8**, **9289–93**, 11,109, **11,136–43**, 11,668, 12,208; of water from private reservoirs, 12,208; of water from reservoirs formed by combination amongst manufacturers, 4873–83; of the water brought from public waterworks, 1462, 1470–1, 2513–16, 2735–9, 7274, **8890–1**, 10,214–7, **11,134–43**, 11,290–3, 11,374–7, 11,658–74, 12,094–100. The water of rivers and becks must, if law does not interpose, become useless for all purposes of manufacture, except as steam power, 2471, 2551–3, 2683, 2780, 3361*–64*, 6938–40, 7522, 11,033, 11,483.
5. Litigation produced, 2391–7, 2510, 3428, 3696, 3708 3822, 6303, 8697, 9118, 9642, **9933–9**, 9953–4, 10,909 11,775–84, 12,013; also 10,655–708, 9684–9709 10,640–54.

IV. Law concerning Pollution, see *Law*.
V. Legislation requisite, see *Legislation, Conservancy*.
VI. Modes of prevention, see *Dye Waste, Grease Extraction, Maltsters, Sewage Irrigation, Tanning Refuse, Ochrey Waters*.

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PONTEFRACT:

Witnesses examined,

Mayor, Mr. Routledge, 15,334–77.
Town Clerk, Mr. Coleman, 15,571–633.
Street Commissioner, Mr. Wordsworth, 15,634–703a.
Inspector of Nuisances, Mr. Fernside, 15,378–467.
Manager of Waterworks, Mr. Turpin, 15,750–826.
Manager of Gasworks, Mr. Gundill, 15,827–70.
Officer of Health, Dr. Muscroft, 16,627–54.
Dr. Atkinson, medical practitioner, 16,574–626.
Mr. Moxon, maltster, 16,555–71.
„ Wood, 15,704–49.
„ Horn, flint grinder, 15,468–570.
„ Heptinstall, corn-miller and maltster, 15,968, 16,120.
„ Brooke, farmer, 16,655–87.
„ Hartley, Bridge Master to West Riding, 15,871–967.

Population, 15,335. Rateable value, 15,337. Local government double, by Corporation and Street Commissioners, 15,340–6, 15,571–684, 16,564–8, 16,599–608, 16,640–1. Mortality, 26 in 1000, 16,569; increasing, 16,630, **16,642**; fever and epidemic diseases decidedly increasing from neglect of sanitary conditions, 16,576–9, 16,633–9. Sewerage, 15,347, 15,417–26, 15,683–8, 15,875–9; very partial, 15,707; neglected, 16,579; and offensive, 16,569, 16,633. Sewage passes into canal, 15,348–57, 15,368–77, and see *Sewage*. Water supply, 15,363–5, 15,694–701, 16,633, and see *Water Supply*, and evidence of Mr. Turpin, 15,750–826. Waterclosets, 175 in number, 15,385. Privies injuriously close to houses, 15,389–91, 16,583, 16,714–15. Are cleansed by owners, 15,428–30. Gasworks, *see* evidence of manager, 15,827–70.

PRIESTLEY, Mr. (of Todmorden):
Evidence of, 12,936–61.

PRIVIES:

At manufactories. Contents passed into river, 1372–5, 4169–74, **6260–1** Table, 6574, 6924,5, 7550, 10,283–5, 10,482–4, 11,297–300, **12,880–9**, 14,140–5. No privy arrangements for 700 men, **8378–82**. Contents used for manufacture, 9868. Contents put on land, 2611–12, 3866, 4304, 4397, 4516–8, 4884–8, 5034–8, 7244–9, 7549, 8075–7, **9187**, 9306–10, 9866–8, 9931–2, 10,283, 10,388–93, 10,808 Letter, **11,019–23**, 11,365, 11,384, 11,675–81, 11,770–2, 11,835–7, 11,907–10, 12,019, 12,047, 12,105–7, 12,227–9, 12,366–7, 12,639–40, 12,660–2, 12,684–6, 12,749, 12,829–30, 12,886–9, 12,949–61, 13,124, 13,148, 13,919–21, 14,008–11, **14,040–4**, 14,203–7, 14,341–2, 14,384–7, 14,479–81, 14,519–21, 14,683–4, 14,744–5, 14,816, 15,100, 16,406–9, 16,559–61. Contents of none ought to be suffered to pass into the river, 7553, **11,093–5**.

„ Batley, 2328–38.

„ Bingley, systematically inspected and cleansed under Commissioners, 13,491–5.

„ Bradford, about 14,000 in number, cleansed by Corporation at a cost of 2,700*l.* per annum, 8846–56; not one placed under dwellings, 8863–5; if converted into waterclosets, removal of dry ashes would cost nearly as much as before, 9052–4.

„ Castleford, sometimes injurious to health, 16,074–9, 16,293–309.

„ Dewsbury, 2243–9, 2253–5, 2287–94, should be cleansed out at shorter intervals.

„ Halifax. Some 1,500 or 1,600 ashpits, 11,596–8; injurious to poor, 12,451–5; some are placed over stream, 12,480–1; most are cleansed by Corporation, only in default of owner; loss to Corporation from process last year, 100*l.*, 10,920–7.

„ Huddersfield, cleansed by Commissioners, 3219*–28*.

„ Keighley, in case of neglect, are cleansed by Local Board, 13,147–8, 13,870–6, 14,777–9.

„ Leeds, 12,000 altogether, of which 1,000 are under dwellings, 6121–3, 6514–25; emptied by Corporation at a gross cost of 6,000*l.* to 7,000*l.* per annum, and a net loss of from 2,200*l.* to 4,000*l.*, 5691–5, 6526, 6538, **6646–8**, 7046–53, 8448–54; cleansing process a nuisance, "the state of Leeds from 10 o'clock at night till about four in the morning something fearful," 6527–30.

„ Pontefract, injurious to health, 15,389–91, 16,583, 16,714–15; owners are called upon to cleanse, 15,428–30.

At Skipton, cleansed by authorities, if neglected by owners, 14,635, 14,907–13; their conversion into water closets found advantageous to health, 14,873–81.

„ Todmorden, 12,734–9; regulations by Local Board as to, 12,949–60, 13,042–3.

„ Wakefield, cause of ill-health and fever, 167–99, 286–94, 182, 532–8; difficulty of cleansing, 204–12; amount of contents annually removed, 167–73; in default of owners, cleansed by Corporation, 207; also exceptionally cleansed by Corporation from fear of cholera, 43–7; better, but more expensive, for Corporation to undertake the whole work of cleansing, 213–16. On the whole improved, 157–8. Contents of workhouse privies put on land, 275.

R.

RAINFALL:

In Aire Dale, **5,770** Tables; at Halifax, 12,416; in Hebble Valley, 11,272–5; at Huddersfield, 5174–7, 5259; at Keighley, 13,226–8; at Leeds, 5813–32, 9616–17; at Skipton, 15,249; at Wakefield, 1693.

RAVENSTHORPE:

Witnesses examined:
Clerk to Local Board, Mr. Rayner, 3105–33.
Mr. Wormald, dyer, 3134–257.
Mr. Tattersfield, fulling miller, 3258–353.
has no water supply, 3113–18; is not sewered, 3121.

RAWSON, Mr. (of Halifax):
Evidence of, 12,125–95.

RAYNER, Mr. (of Ravensthorpe):
Evidence of, 3105–33.

RESERVOIRS:

Equalize river-flow and diminish floods, 3081, 3424–5, 3264*–6*, 4871–2, 10,002, 14,012; payment by manufacturers for use of, 3551–6, 3579, 3597, **4873–83** 4957–8, 8062–8, 8223–31, 8915–31, 10,165–8, 10,927, 14,208–14; and *see* evidence of Mr. Brigg, 14,012–25 Provision as to bye-wash of, 10,192–298, 11,562–89, 14,933–57, 14,107–8; sometimes discharged carelessly, 13,298–309.

RHODES, Mr. (of Wakefield):
Evidence of, 1–85.

RICHARDSON, Mr. (of Halifax):
Evidence of, 11,255–82, 11,494–598.

RIDGWAY, Mr. (of Dewsbury):
Evidence of, 2561–84.

REFFITT, Mr. (of Leeds):
Evidence of, 8464–578.

RILEY, Mr. (of Esholt Hall):
Evidence of, 9560–616.

RIPARIAN PROPRIETORS:

See evidence of Mr. Constable, 9617–83; Mr. Darwin, 5580–625; Mr. Ferrand, 5481–579, 13,295–369; Captain Graham, agent to Sir J. Ramsden, 4072–5146; Mr. Holmes, 9505–59; Mr. Mitchell, 9463–504; Mr. Nicolson, agent to Sir R. Tufton, 15,205–94; Mr. Pollard, agent to Sir John Lowther, 6451–505; Mr. Riley, gardener, 9560–91; Colonel Smyth, 2051–113. Should be bound to cleanse river-bed, 5517. Increase of value of land from growth of manufactures, 9217, 9323–5, 9634–5.

RIPLEY, Mr. (of Bradford):
Evidence of, 10,435–639.

ROAD SCRAPINGS:

Thrown into river, 3199*–3202*, 12,010–628, 12,913–15, 12,948, 13,161–2, 13,623, 13,829–30; might be usefully applied to raising land, 3208*–10*; at Leeds 9,000 tons sold annually, 6589–91.

ROBINSON, Mr. (of Honley):
Evidence of, 4365–455.

ROBINSON, Dr. (of Leeds):
Evidence of, 6085–171.

ROBSON, Mr. (of Mold Green, Huddersfield):
Evidence of, 5260–310.

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Rodley, Mr. (of Todmorden):
Evidence of, 13,001–45.

Roodhouse, Mr. (of Wakefield):
Evidence of, 1067–95.

Routledge, Mr. (of Pontefract):
Evidence of, 15,334–77.

S.

Salmond, Mr. (of Bradford):
Evidence of, 10,750–94.

Sanitary Arrangements. See *Lodging-houses. Privies. Scavenging. Sewage. Sewerage. Smoke. Water-closets. Water Supply.*

Scavenging:
Of river, necessary and neglected. Nuisance of floating carcases, 50, 677–82, 707–12, 754–5, 1244, 1297–302, 2284–5, 2413, 3072, 3464–7, 5509–11, 5586, **5643–4**, 6539–44, 6720, 6944–50, 7196–8, 15,119, 16,031–9, **16,132–6**; at Leeds the scavenger has removed 50 carcases in a day, 6542.

Scott, Mr. (of Skipton):
Evidence of, 14,725–62.

Seed, Mr. (of Huddersfield):
Evidence of, 5114–51.

Sewage:
Of sewers (sewerage being in every town only partially adopted) of Batley, passes into beck, 2316–88.
„ Bingley, passes into Aire, 13,471, 13,352–4, 14,364.
„ Bradford, passes into beck, 8654.
„ Castleford, passes into Aire & Calder, 15,502–4, 16,235–6.
„ Dewsbury, passes into Calder, 2209.
„ Halifax, its volume, 11,502–5; passes into beck, 10,829, 10,843, **10,901–10**.
„ Harrogate, passes into river Nidd, and spoils water supply of Knaresboro' 5771–87.
„ Honley, passes into stream, 4436.
„ Huddersfield, passes into Colne and canal, 2927*–29*, 3124.*
„ Keighley, passes into Aire, 5519–21, 13,109, 13,877–9.
„ Knottingley, passes into Aire and Calder, 16,362.
„ Leeds, its volume, from 6,000,000 to 8,000,000 gallons daily, 5942; increasing from increase of population and extension of sewerage, 6484; passes into the Aire, its effect at the outlet, 806–9, 819, 5583–9, 5620–1, 5887, 6462–3, 6504, 6719, **7670–6, 7704–11**, 8087–91, 8098–102, 8112–17; possibly predisposed to cattle plague, or aggravated plague, 5584, 5621–5, 5761–6, 7680–2; *secus*, 8259. Pollution extends below Castleford, 810–5, 8103–7, 15,487, 16,153–6; the solid matter obstructs navigable channel at Castleford, **16,176**, 16,191.
„ Lockwood, passes into river, 4607.
„ Mold Green, passes into river, **5312** Paper.
„ Pontefract, is collected into tanks and allowed to get putrid, 16,714–5; passed thence into Goole canal, 15,348–57, 15,368–77, 15,708–21. Goole canal runs through Knottingley, and inhabitants of Knottingley draw part of their water from this polluted source, 16,544–7. The canal enters Ouse at Goole, 15,461–7. The sewage tanks are a nuisance, 16,540–5.
„ Wakefield, passes into river, **85–6** Paper III.; even sewage of Asylum, 270–3, 563, 618; and prison, 98, 253–8, 260–8, 561–2, 618, 2133. Flood of, beneath floor in prison, immediately caused diarrhœa amongst inmates, **2146**.
Law against casting into streams, quite inoperative, 2118–22. See *Sewerage, Waterclosets. Pollution. Legislation.*

Sewage Irrigation:
Right to be carried out, though it cost a town like Wakefield 1,000*l.* per annum, 82–3. Successfully carried out by Mr. Ferrand, 5526–33; and at Grange, 6476–80. Objected to, 11,181, 11,184–98. Is sewage of manufacturing town valuable for irrigation? 6486–93. Cost of pumping sewage according to Mr. Filliter one halfpenny per 1,000 gallons for pumping 250 feet, **5856–8, 5940–1**, 5953–4; as compared with cost of removing contents of privies, 7124–6, 8448–54; as compared with a gravitation scheme of irrigation, 5905–11. Valley of Aire generally fitted for, 5526, 5767. No land available immediately below Bradford, 9068–9, 10,114; and volume of sewage to be pumped 20,000,000 gallons daily, 8935–40; land available below Castleford, 16,264–5, 16,514–5; below Keighley, subject to the necessity of pumping, 13,264–6; below Leeds, 5766, 7076; two areas, one of 10,000 acres accessible by gravitation, the other of 5,000 acres free from residential property, but not available except with pumping, **5936–41**. Volume to be pumped, 10,000,000 gallons daily, 5942–53; cost of pumping, 2,300*l.* per annum, **5940–1, 5953–4**, less than present cost of cleansing privies, 7124–6, 8448–54; would be more than recouped by increase of value of land caused by irrigation, 5955–62. Below Pontefract, land available, 15,692–3, 16,563. Below Skipton, valuable meadow land available without pumping, 14,655–63 14,893, 15,231–40.
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Of Batley, 2315, 2324–6.
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Keighley, 13,168; sewers insufficiently ventilated, 13,858–65, 14,780–7.
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Pontefract; 15,347; very partial, 15,707; ill-flushed and ill-ventilated, 15,417–26, 15,683–8, 15,875–9, 16,569; not trapped, 16,633; and neglected, 16,579–85.
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Todmorden, very bad, 12,858–60.
Wakefield, incomplete, 20, 76, **85–6**, Paper, 610–2, 633–5; plans of, old, 627–33, 1100–9. Sewers ill-ventilated and ill-flushed, and so very foul, 620–6; effect of bad ventilation of sewers of prison, **2141**. Outfall of sewers too low, 1105. Private drains ill-constructed, 1110–3.

Sharp, Mr. (of Keighley):
Evidence of, 13,821–924.

Shaw, Mr. (of Halifax):
Evidence of, 12,331–412.

Shoddy, no cause of river pollution, 2412. *See* evidence of Mr. Jubb, 2363, 2481

Sidgwick, Mr. C. (of Skipton):
Evidence of, 14,621–66.

Sidgwick, Mr. R. (of Skipton):
Evidence of, 14,667–724.

Simpson, Dr. (of Pontefract):
Evidence of, 16,280–371, 16,572–3.

[*Numbers* 2919–3467 *are repeated in the Evidence: when the reference is made to the numbers as used the second time, the numbers are distinguished by an asterisk.*]

SIMPSON, Mr. (of Castleford):
Evidence of, 16,372–427.

SKIPTON:
Witnesses examined:
Chairman of Local Board, Mr. Sidgwick, 14,622–66.
Surveyor of Local Board, Mr. W. Bradley, 14,864–922.
Vice-Chairman of Board of Guardians, Mr. B. Bradley, 15,120–204.
Manager of Waterworks, Mr. Calvert, 14,923–15,008, 15,295–308.
Foreman of Gasworks, Mr. Clarke, 15,309–33.
Registrar of Births and Deaths, Mr. Bailey, 15,065–89.
Mr. Marsden, surgeon, 15,009–64.
,, Heelis, 14,712–24.
,, R. Sidgwick, cotton spinner, 14,667–724.
,, Dewhurst, cotton spinner, 14,800–63.
,, Horner, lead manufacturer, 15,090–119.
,, Scott, brewer, 14,725–62.
,, Nicolson, agent to Sir R. Tufton, 15,205–94.
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Mortality, 26 in a thousand, 15,069, and *see* evidence of Mr. Bailey, 15,065–89, 15,147–53. Health improved, 15,013–29. Sewerage imperfectly constructed, 14,633, 14,866–73, 15,212–28; See *Sewerage*. Sewage; contents of sewers pass into river, 14,639–45. See *Sewage*. Cesspools, 14,634–7, 14,874–81, 14,907–15; 100 waterclosets, 15,212–28. Water Supply, 14,923–15,008, 15,295–308, and see *Water Supply*. Gasworks, 15,309–33.

SLEE, Mr. (of Bradford):
Evidence of, 9710–67.

SMITH, Mr. C. (of Leeds):
Evidence of, 7767–876.

SMITH, Mr. J. E. (of Leeds):
Evidence of, 5626–705.

SMITH, Mr. F. (of Halifax):
Evidence of, 11,283–361.

SMITH, Mr. G. (of Wakefield):
Evidence of, 1222–34.

SMITH, Mr. S. (of Bradford):
Evidence of, 9252–9349, 10,709–49.

SMITH, Mr. S. (of Leeds):
Evidence of, 7733–66.

SMITH, Mr. W. (of Keighley):
Evidence of, 13,523–614.

SMOKE PREVENTION, 11,858–67, 11,967–78, 12,140–95, 12,306–17, 12,347–51, 12,389–410, 12,513–25, 12,927–35, 12,995–13,000, 13,349–53, 13,588–98. Produces much less ash, **12,190**.

SMYTH, Col. (of Wakefield):
Evidence of, 2051–113.

SOAP MANUFACTURE AND SOAPSUDS. See *Grease Extraction*.

SOLID REFUSE IN RIVER:
" I. Kinds of refuse.
II. Extent and effects of obstruction.
III. Necessity of legislative interference.

I. Kinds of refuse:
Ashes, tipped into streams, 756–7, 1249–50, 1294, 1324–34, 2381, 3016*, **3210*** TABLE, 3399*–401*, 3523–7, 4303–4, 4575, **4613**, 4823, 5017, 5501–4, 12,671–4, 12,682, 12,687–701, 12,746–7, 12,793–6, 12,802, 12,874–5, 12,632–8, 14,127–34. Carted away, 1350, 1638, 1858–60, 1878–9, 3127–8, 3813–4, 4164–6, 4376–7, 4514–726, 5270–1, 6799, **6889**, 7192, 7647–52, 7870–1, 8038–42, 8519–20, 9140–4, 9296, 9924–6, 10,288–92, 10,380–2, **10,513–9**, **11,009–18**, 11,155–60, 11,294–6, 11,368–71, 11,604–6, 11,728–30, 11,832–4, 11,903–6, 12,090–3, 12,136–9, 12,201–2, **12,345**, **12,352–3**, 12,618–20, 12,965–9, 13,530–41, 14,339–40, 14,458, 14,486–8, 14,557–61, 14,818–9, 15,496–501, 15,974–6, 16,380–2. Expense of removal of, 1878–83, 6801, 6900–1, 8041, 11,018, 13,537–9, 14,134, 14,155–60, 14,340. Might be utilized for roads, 3124* and *passim*, when ground served as a substitute for sand in cement, 2936*, 4514, 4731–6. Ordinary proportion of ashes from coals, 4368, 4641, 4821–2, 6884; might be greatly reduced by proper consumption of smoke, 12,190. All ashes should be kept out of streams, 3391–2, 3019*, 3528, **6893–8**, 9302, **10,519–23**, 11,092, 11,455, 11,710, 12,117, 12,622–3.
Debris from mountains, 3271*–2* Paper, 3318, 12,699 how to be intercepted, **57,314**, 12,814–7, 12,908–10, 12,978, 15,164–9, 15,272–6.
Dyewood, thrown into river, 2240, 2381–2, 2571–6, 2583, 6790, 7958, 9125–9, 12,218–20; to the great injury of the bed, 793–6; might be all kept out without hardship to manufacturers, 1868, 2503–9, 2538–9, 2625–6, 2723, 2740. Its use for land may be questionable, 2713–21, 10,493, though it is occasionally bought by farmers, 8507–10; but chipped dye-woods are easily collected, and burnt under boilers, 1437, 1590, 2601–2, 2722, 3036*, 3397*, 5291, 8511, 11,641, 11,993–9, 12,104, 14,810–2. Rasped dyewoods may be collected with a little trouble, and though unfit for fuel, may be made into a spoil heap, and so burnt, 6793, 6841–3, 7974–6, 9297, **10,495–505**, **11,099–106**, 11,643–5, 11,760–1, **12,024–6**.
Excavations, 2934,* 3122*–3,* 4085, 4408–9, 12,323, 12,764, 12,970–1, 13,622, 13,831, 14,160.
Foundry refuse, 5504, 13,622.
Fuller's earth, 3244–54.
General refuse, **5500**.
Lead-mines, **8141–77**.
Road scrapings, 3199*–202, 12,010, 12,628, 12,913–5, 12,948, 13,161–2, 13,623, 13,829–30; might be usefully applied to raising land, 3208*–10*; at Leeds 9000 tons sold annually, 6589–91. Sediment flushed out of reservoirs or tanks into the river, to be flushed again successively by millowners lower down the stream, 2837–55, 3208–16, 3051*–75,* 3061*–2,* 3532–5, 4432–3, 4824–7, 10,471, 10,524, **10,528–33**, 11,040–8, 11,268–70, 12,380–8, 13,629–30, 14,265–88, 14,381–3, 14,562–4; out of canal into Calder, 12,585–95; can the mud so flushed out be utilized? 3214–6.
Sewage, 16,176–91.
Wool waste, 757–63, 1540–3, 4643–54.
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The bed is raised, 693, 3366–92, 3197*–8,* 3203,* 3302,* 3406,* 3529–31, 4386, 4520, 4549, **4616–7**, 4942, **5422** Paper, 5736–9, 8641–8, 11,265, 12,802–4, 12,898–901, 12,942, 13,156, 13,467–8, 13,515–22, 13,541–6, 13,619, 13,690, 13,736, 13,827, 13,832, 13,898–909, 14,056–7, 14,122, 14,148–51, 14,515, 15,933. Is the raising of the bed due more to refuse thrown into the stream or to mountain debris? 12,987–8, 14,160, 14,167, 13,159. Banks become irregular, 3123,* 4942. Floodings are caused, 3048,* 3204,* 3303,* 3537–40, 5422 Paper, 12,028–31, 12,634, 13,547–9, 13,599–614, and see *Floodings*. Drains are backed up, 13,157–8, **13-599–614**, 13,627, 13,814–9, 13,833–7, 13,923–40. Water-power is decreased, **11,942**, **12,602–16**, **14,099–100**. Navigation impeded, and the requisite dredging enormously increased, 740–7, 7635, 1224–43, 1253, 7318–33, 7348. **7467–8** TABLES, **16,153**, **16,169–76**. *See* evidence of Mr. Bartholomew, Engineer to Aire and Calder Navigation, 7300–468; of Mr. Holmes, 735–830; of Mr. G. Smith, 1222–334; of Mr. Oates, 3354–467; of Mr. Wilkinson, 16,121–99. Material dredged up, not sand, but ashes and filth, 1249–50, 1294, 3220–2, 3293, 3393–410, **16,174–6**, **16,189**.
III. Necessity of legislative interference—
The throwing in of rubbish is prohibited under the Aire and Calder Navigation Acts, 1326–34, 1871–8, 2060, 6890, 7485; but the prohibition applies only to Navigation Channel, not to becks, 2066–7, 7328–32, 7477–8.
All solid refuse should be excluded from all running streams, 2431–2, 2740–5, 2751, 2935*–6,* 3415*–7, 4360, 4550–4, 4604, 8390, **8829–30** Letter, **11,086**, 11,424, 11,802–3, 11,885, 12,016–9, 12,304, 12,510, 12,757, 12,902, 13,323, and see *Legislation, Conservancy*.

SPENCER, Mr. T. (of London):
Evidence of, 1714–837, 1982–2051.

STANSFIELD, Mr. (of Todmorden):
Evidence of, 12,702–39.

STATTER, Mr. (of Wakefield):
Evidence of, 1152–1221.

STEWART, Mr. (of Wakefield):
Evidence of, 1,642–70.

SUGDEN, Mr. (of Bingley):
Evidence of, 14,516–96.

SUTCLIFFE, Mr. (of Idle):
Evidence of, 9916–81.

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SUTCLIFFE, Mr. (of Todmorden):
Evidence of, 12,596–655.

SWALE, Mr. (of Leeds):
Evidence of, 6506–660.

SWALLOW Mr. (of Bradford):
Evidence of, 9350–462.

SYKES, Mr. (of Wakefield):
Evidence of, 831–1029, 1670–89.

T.

TANNERS:
Witnesses examined,
At Bradford, Mr. Slee, 9710–67.
„ Keighley, Mr. Cockshott, 13,649–77.
„ Leeds, Mr. Nickols, 6261–451.
„ Mr. Tatham, 7506–664.

TANNING:
Extent of at Leeds, 2,750,000 hides tanned in one year, 6369. Materials used, **6450** PAPER; in some cases human excrement, 6581–6. Abundance of pure water necessary, 6313–7, 6322–5, 6347–63, 6355–60, 7516–20, 7571–4. Waste products; spent solids led away for manure, 6284, 6341; spent bark burnt, 6300, or led away, 7652–60, 9278–9. Means of disposing of waste liquid must be had or the trade cannot be carried on, 6395–403, 6411. At present, waste liquid chiefly passes into stream, 5634, 6281, 7526, 8524, 14,291–3; fit for irrigation, only if ample area available, otherwise too strong and too salt, 6304–12, 6320–37; might be passed into sewers and, mixed with sewage, be applied for irrigation, 6364–6, 6378, 6405–6, 9759–65.

TATHAM, Mr. Alderman (of Buslingthorpe, Leeds):
Evidence of, 7506–664.

TATTERSFIELD, Mr. (of Ravensthorpe):
Evidence of, 3258–353.

TEALL, Mr. (of Wakefield):
Evidence of, 316–456.

TENNANT, Mr. R. (of Leeds):
Evidence of, 6864–999.

THOMPSON, Mr. (of Bradford):
Evidence of, 9762–862.

THORNHILL:
Witnesses examined:
Clerk to Local Board, Mr. Oldroyd, 2919–29
Mr. Charlesworth, maltster, 3041–104.
Mr. Maddison, colliery proprietor, 2930–3040.
Polluted canal the only water supply, **2934–63**.

THORNTON, Mr. (of Huddersfield):
Evidence of, 3211*–72*.

TINKER, Mr. (of Holmfirth):
Evidence of, 5215–59.

TODMORDEN:
Witnesses examined:
Chairman of Local Board, Mr. J. Fielden, 12,844–70.
Surveyor and Inspector of Nuisances, Mr. Rodley, 13,001–45.
Mr. Bamford, surveyor, 13,046–92.
„ Hamerton, solicitor, 12,772–85.
„ Buckley, machine maker, 12,656–74.
„ J. Lord, do., 12,894–935.
„ E. Lord, do., 12,962–13,000.
„ Stansfield, nurseryman, 12,702–39.
„ Sutcliffe, corn-miller, 12,596–655.
„ Chambers, cotton spinner, 12,740–71.
„ J. Fielden, do., 12,786–843.
„ R. Fielding, do., 12,675–701.
„ Ormerod, do., 12,871–93.
„ Priestley, draper, 12,936–61.
Not sewered, 12,859–60; suffers from floodings, *see* 12,596–13,092, and evidence taken at Todmorden, *passim*; especially, 12,641–5, 12,702–8, **12,754–6**, 12,974–5, **13,014–29**, 13,053–92.

TOWNEND, Mr. (of Cullingworth):
Evidence of, 14,179–329.

TURNER, Mr. (of Huddersfield)
Evidence of, 2919*–65*.

TURPIN, Mr. (of Pontefract):
Evidence of. 15,750–826.

TWEEDALE, Mr. (of Dewsbury):
Evidence of, 2900–18.

V.

VENTILATION:
Of sewers insufficient, *see Sewerage*.

VITRIOL WORKS:
See Evidence of Mr. Leather, 9862–912.

W.

WADE, Dr. (of Wakefield):
Evidence of, 283–315.

WAKEFIELD:
Witnesses examined.
The Mayor, Mr. Rhodes, 1–85, 2114–8.
Deputy Town Clerk, Mr. Morgan, 86–118.
Inspector of Nuisances, Mr. Johnson, 152–282.
Borough Surveyor, Mr. Lynam, 609–65.
Late Borough Surveyor, Mr. Crutchley, 1096–1151.
Manager of Waterworks Company, Mr. Sykes, 831–1029, 1670–89.
Solicitor, do. Mr. Lumb, 1030–66.
Consulting Chemist of ditto, Mr. Spencer, 1714–837 1982–2051.
Registrar of Union, Mr. Stewart, 1642–70.
Mr. Fowler, surgeon, 457–544.
„ Alderman Holdsworth, M.D., 544–608.
„ Milner, surgeon to Prison, 2124–70.
„ Statter, surgeon, 1152–221.
Dr. Wade, 283–315.
Dr. Wright, 2171–98.
Mr. Holmes, captain of dredger, 735–830.
„ G. Smith, do. do. 1222–334.
„ Woolass, aqueduct keeper, 666–734.
„ Teall, soap extractor, 316–456.
„ Wilson, soap maker, 1617–41.
„ Barker, worsted manufacturer, 1335–444.
„ Goldthorpe, do. 1445–1543.
„ Perkin, cocoa-nut matting manufacturer, 1544–616.
„ Dent, dyer, 1838–925.
„ Hick, copperas manufacturer, 1926–81.
„ Oakes, do. 119–45.
„ Roodhouse, do. 1067–95,
„ Childe, civil engineer, 1690–714.
Col. Smyth, 2051–113, 2119–23.
Rev. Mr. Bowditch, 2199–201.
Area and Population, 18, 86–92; 118 Table. Rateable value, 19, 88; Local Government, 90. Health and mortality; death-rate increasing, 1653, 1669–70 Table. Manufactures, 118 Tables. The dyeing trade for Bradford or Leeds has now left Wakefield on account of pollution of Calder, 10–11, 124–7, 1345. Sewerage incomplete, 20, 76, **85–6** Paper, 610–2, 633–5; plans of, old, 627–33, 1100–9. Sewers ill-ventilated, and ill-flushed, and very foul, 620–6; effect of bad ventilation of sewers of prison, 2141; outfall of sewers too low, 1105; private drains ill-constructed, 1110–3. Sewage passes into river, **85–86** Paper, 111; even sewage of asylum, 270–3, 563, 618, and of prison, 98, 253–8, 260–8, 561–2, 618, 2133. Cesspits done away with almost entirely, 160–6. Privies, cause of ill-health and fever, 167–99, 286–94, 182, 532–8; difficulty of cleansing, 204–12; amount of contents annually removed, 167–73; in default of owners, cleansed by Corporation, 207; also exceptionally cleansed by Corporation from fear of cholera, 43–7; a better but more expensive plan for Corporation to undertake the entire work of cleansing, 213–6; on the whole privies improved, 157–8, Contents of workhouse privies put on land, 275. Waterclosets adopted for the rich, 99, 158, 200–3, 615–7; not for cottages, 202–3, 608. Slaughter-houses, 33–7, 217–24. Gasworks, 38–42. Water supply, from Calder below sewage outlet, see *Water Supply*. Rainfall, 1693. Gas works, 38–42. Becks, **543–4** Paper, 649–60.

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WALKER, Mr., of Bradford:
Letter from, 10,808–9.

WATERCLOSETS:
At Bradford 1,500 in number, 8845; at Castleford, nine, 15,988; at Dewsbury, few, 2243–4; at Halifax, 960 in number, 10,837, 12,454, 10,918–9; at Keighley, discountenanced by Local Board, 13,125, 13,869, 14,763–79. At Leeds 3,000, 6026, and are approved by local authorities, 64, **6545–52**; still not 100 in workmen's houses, 6649, **7128**; at Pontefract, 175, 15,385; at Skipton, one hundred, 15,212–28; at Wakefield, partially adopted, but not approved of by Local Board for cottages, 99, 158, 200–3, 608, 615–7; used at mills with advantage, 10,482–4.

WATER-POWER:
3297–3306, 3376*–78*, 3386–90, 3507–14, 4708–14, 8750–3, 10,956–9, 12,376–7, 14,051–5, 14,102–6. Diminished by solids thrown into the river, 11,942, 11,957–60, 14,099–100.

WATER SUPPLY:
I. For Towns.
II. Value to Manufacture.
III. In reference to Geological Strata.

1. For Towns:
Bingley; springs collected into a reservoir, 13,472–4, 14,348–9.

Bradford: *see* evidence of Mr. Leather, 10,165–8; of Mr. Gott, **8866–999**, 8915–31, 9019–41; works owned by Corporation, 8866; supply unlimited, 883[illegible]; volume daily consumed 2,000,000 gallons for domestic use at rate of 16 gallons per head of population and public use, and 2,500,000 of gallons for trade purposes, 8880–2; price for trade purposes, 8890–1. Well supply, precarious; old wells are drained by new wells sunk deeper, 9198, 9281–9.

Castleford: no regular supply; population resort to wells liable to infiltration of sewage and to be drained by colliery pumpings, 16,508, 16,063–7, 16,215, 16,285–7, also to polluted river, 16,212–7, 16,285–91, 16,648–54, 16,669–75, 16,343 Paper, 16,357–60. Pollution of wells probably cause of cholera, 16,351–4.

Dewsbury: 2223–7.

Fartown; only polluted stream, 4759–66.

Halifax; *see* evidence of Mr. Norris, **10,853–900**; in hands of Corporation and very good, 10,815–6, 11,237; total volume and in what proportion distributed for domestic and trade consumption, 10,870; economy of, necessary, 10,876; deficiency of, has impeded development of trade, 10,996–7; contemplated extension of, 10,877–81. Penalties under Local Acts for not sending sufficient compensation water down the Hebble Valley, 10,896–99.

Huddersfield; *see* evidence of manager of works, Mr. Hare, 5152–5214. In hands of independent Commissioners, 2947*–8*, 2951*–3*, 5201–6, 5213–4; insufficient, 3561–5, 5178–82, 5193–4; reservoirs once ran dry, 5169.

Keighley; reservoirs in hands of Local Board, 13,110–9, *see* evidence of Mr. Booth, 13,211–60.

Knaresboro': polluted by sewage of Harrogate, 5771–87.

Knottingley: used to be from river then pure, 16,721; now partly from wells liable to pollution, 16,356–60; partly from canal which has received sewage of Pontefract and other pollutions.

Leeds: formerly by company from river Aire, 5436, 5999, 8326; now by Corporation from Wharfe, 6018–9, 5437–9, 5598–5604, 5617; supply for domestic use unlimited and constant, 6033–4; volume used 16 gallons per head, 6006–9; and *see* evidence of Mr. Filliter, 5833–66. Volume supplied to manufacturers 500,000 gallons daily, 6007; charge 6*d.* per 1,000 gallons, 6021. Manufacturers want more and more, and their wells are failing, 6022–3, 6073–4; the richest sink the deepest wells, and so drain those of their neighbours, **7135–41**. Quality, 5894–7, 8222. 10,071. Wharfe becoming polluted by sewage and manufacturing refuse, 5893, 5898–902, 6114–7, 7093–5, 8187, and is peaty, 5916, 7151–2; can peatiness be prevented? 6081–4. A new supply required of water, more pure, more soft, more abundant, 5893, 5903–4, 7090; proposed source, the Washburn, 5931–5, 5965–98, 5990–3, 8188, 10,018–38, 10,071.

Pontefract; *See* evidence of Mr. Turpin, 15,750–826; in hands of Commissioners, 15,363–5; from a well, not constant, 15,762; hard and quite insufficient. 15,694–701, 15,821–2, 15,865–8, **16,633**. Private wells occasionally infiltrated with sewage, 16,649–54.

Ravensthorpe; none, 3113–8.

Skipton; *See* evidence of manager of works, Mr. Calvert, 14,923,15,008,15,295–308. A constant system by gravitation, 14,964–75. Usually 20 gallons per head, 14,960; but liable to run short, 15,241–2, 15,295–308.

Thornhill; none. *See* evidence of Mr. Maddison, 2930–63, 2934, 3073–6, 3084–5.

Villages; generally poor, streams, which are natural sources, being polluted, and artificial waterworks not yet having been established, 5469–70, 5557, 5604, 7299, 16,609. Bradford supplies neighbouring villages, 7298. Halifax also, 10,892–3, 11,591–4.

Wakefield. *See* evidence of manager of works, Mr. Sykes, 831–1029, 1670–89. Mr. Spencer, chemist, 1714–837, 1982–2051, and Paper by Mr. Whittam, **85–86**.

In hands of private company, 23, 56–60, 75, 867–83, 1052–5, 1165–8. Source of, as to one quarter springs, as to the remainder the river Calder at a point below the town after the river has received sewage and other pollutions of town, 834–5, 24–6, 77, 94, 272, 1060. The sewerage of town hitherto partial, but sewerage is being extended, and population and manufactures are likewise increasing, 20, 76, 78–80, 93, 111, 159, 163, 1063. Mode of procuring from the river, 1670–89. Water pumped into a reservoir after a fresh, 859–60, 913, 952–3, 1670–2; then deposits, 915; then upper part of water is passed. Formerly only one reservoir; when that was being cleaned out, water pumped directly from river into mains; additional reservoirs now constructed, 1670–89. Reservoir contains fish, 957–62; Water formerly unfiltered, 851–4, and was then distinctly injurious, 461–71, 476, 505–6, 543–4 Paper; now filtered by Mr. Spencer's carbide process, 851–4. Process described, 898, 925–44, 998–1006, 1178–204. Cost of carbide, 1027–8. Effect of filtration; a very fair water produced, not injurious to health, 114–8, 146–8, 311–5, 478, 495–6, 500, 515–24, 1160, 2191; but harder in consequence of process, 486–93, 570–3, 1008–24, 1464–6; and not to be trusted, 513–4, 2153; still contains nitrogenized organic matter, 2201. Analyses, 987, 991–6, 1029. Volume of, supply constant and sufficient, 836–7, 862. Proportion of manufacturing and domestic consumption, 840. Price of, 841–4.

Possible rival schemes for, 884–96, 1066, 1713–4 Paper. Proposal for works to be bought up by county rate, 10,962–71.

II. Value to manufacturers, 2553–6, 5912–5, 6054–5, 7102–8, 7143–5, 7584, **7938–41, 8812**, 9062, 10,996–7, **11,238–40**. Cost of wells to individual manufacturers, 9135–7, 9160–7, **9193–8, 9289–93**, 11,109, **11,136–43**, 11,668, 12,208; of private reservoirs, 12,208; of water from reservoirs made by combinations amongst manufacturers, 4873–83; of water bought from public waterworks, 1462, 1470–1, 2513–6, 2735–9, 7274, **8890–1**, 10,214–7, **11,134–43**, 11,290–3, 11,374–7, 11,658–74, 12,094–100. Litigation concerning, 2329–7, 2510, 3428, 3696–708, 3822, 6303, 8697, 9118, 9642, **9933–9, 9953–4**, 10,909, 11,775–84, 12,013. Volume of water used by individual manufacturers, 1377, 2754a–59, 2829–30, 3435*–43*, 3632, 3638–43, 4290, 4579, 4846–8, 4889–93, 4903, 5294, 6782, **6806–7**, 6848–54, 6877, 6951–76, 7930, 8472, 8490–506, 9135, 9154–8, 9269–80, 9722, 9905–10, 10,294, 10,384, 10,471, 10,756, 11,024, 11,234, 11,292, 11,609, 11,842, 12,094–100, **12–336**.

III. In reference to Geological Strata.

α. From coal measures variable: contains iron at Wakefield, 1459–60; is hard at Wakefield, 147, 487–8, 1480–2, 1707, 1712–3, 3517–20, 3953; at Halifax, 11,670–4, 11,733–41; at Bradford, 10,471–6. Pure at Leeds 8356–76, 83,99–401, 10,472–3. Alkaline, at Castleford, 16,516–7; at Leeds, 5844–5.

β. From magnesian limestone; bad; is impregnated with lime at Knottingley, 16,518–22, 16,612–9, 15,700–1, 15,821–2; at Pontefract, 16,357–8.

γ. From millstone grit. Is good and soft at Bradford, 9135–7, 10,297, 10,471; at Halifax, 12,336, 12,354–9; at Keighley, 13,274–5; at Sowerby Bridge, 1706; from the Washburn, 5931–4

WEATHERHILL Mr. J., (of Batley):
Evidence of, 2312–62.

WEIRS:
On the Aire, **5770** Paper; on Bradford beck cause flooding, 8912; action of in time of flood, 5755–9, 7397–8.

[*Numbers* 2919–3467 *are repeated in the Evidence: when the reference is made to the numbers as used the second time, the numbers are distinguished by an asterisk.*]

WHITHAM, Mr., (of Wakefield):
Paper by, **85–6.**

WIGHTMAN, Dr. (of Halifax):
Evidence of, 10,809–37.

WILKINSON, Mr. (of Castleford), Agent of Aire and Calder Navigation Company:
Evidence of, 16,121–99.

WILSON, Mr. (of Leeds), Secretary of Aire and Calder Navigation Company:
Evidence of, 7468–505.

WILSON, Mr., (of Wakefield):
Evidence of, 1617–41.

WILSON, Mr. W. (of Castleford):
Evidence of, 16,484–517.

WIRE MANUFACTURE:
See evidence of Mr. F. Smith of Halifax, 11,283–361. Refuse from, oxide of iron, and green vitriol, and spent sulphuric acid, thrown into river, 11,344.

WOOD, Mr., (of Dewsbury):
Evidence of, 2202–260.

WOOD, Mr. W. (of Pontefract):
Evidence of, 15,704–749.

WOOL MANUFACTURE:
For general information concerning, *see* evidence of Mr. Hirst, secretary of Chamber of Commerce at Leeds, 7877–7922; Mr. Mellor, president of Chamber of Commerce at Huddersfield, 4147–4285; Mr. Ripley, president of Chamber of Commerce at Bradford, 10,435–639; statistics by Mr. Behrens, vice-president, 10,808–9.
Weight of wool used by individual manufacturers, 1504, 2578–9, 3570, 4182, 4319, 4583–91, 4848, 6847, 7270, 9178–85, 9265–8, 9902, 10,400, **10,566–7,** 11,053 11,110, 11,383, 11,616, 12,108, 12,226, 12,335, 14,493, 14,524. Process of washing, 1394, 1402, 1507, 3615, 3644, 7239–60, 14,436, 14,540–3, 10,421–34, 14,506–10. See also *Grease Extraction, Dye Waste, Liquid.* Unwashed wool before scouring will, if soaked, yield potash, 371–7, 442–7. Much wool waste in river, 756–63, 1540–3, 4643–54.

WOOL MANUFACTURERS:
Witnesses examined,
At Bradford, Mr. Godwin, 8659–727.
„ „ Mitchell, 9463–504.
„ „ Ripley, 10,435–639.
„ Dewsbury, Mr. Auty, 2585–2675.
„ „ Ellis, 2676–823.
„ Halifax, Mr. Beaumont, 12,580–95.
„ „ Clay, 11,720–824.
„ „ D. Clay, 12,196–248.
At Halifax, Mr. Cronhelm, 11,896–985.
„ „ John Crossley, 10,992–11,144.
„ „ Rawson, 12,125–95.
„ „ Shaw, 12,331–412.
„ Huddersfield, Mr. Armitage, 3675–807.
„ „ H. Brooke, 3504–674.
„ „ T. Brooke, 4816–969.
„ „ Crosland, 4500–64.
„ „ Crowther, 4565–705.
„ „ Kenyon, 3808–903.
„ „ Mellor, 4147–285, 5387–400.
„ „ Wrigley, 5004–113.
„ Leeds, Mr. Alderman Carter, 7000–161.
„ „ „ Yewdall, 7163–229.
See also *Dyers, Worsted Manufacturers.*

WOOLASS, Mr. (of Stanley Ferry, near Wakefield):
Evidence of, 666–734.

WORDSWORTH, Mr. (of Pontefract):
Evidence of, 15,634–15,703*a*.

WORFOLK, Mr. (of Knottingley):
Evidence of, 16,688–750.

WORMALD, Mr. (of Dewsbury):
Evidence of, 3134–3257.

WORSTED MANUFACTURE. For general information concerning, *see* evidence of Mr. Ripley, 10,452–65, **10,559–64,** and statistics of Mr. Behrens, 10,808–9.
Witnesses examined:
At Bradford, Mr. Anderton, 10,262–322.
„ „ Illingworth, 10,373–434.
„ Halifax, Mr. Child, 11,825–95.
„ „ Holdsworth, 11,362–495.
„ „ Morris, 12,291–330.
„ Keighley, Mr. Brigg, 13,981–14,108.
„ „ Clough, 14,365–454.
„ „ Graham, 14,763–99.
„ „ Townend, 14,179–329.
„ „ Laycock, 14,330–364.
„ „ Marriner, 14,453–515.
„ „ Sugden, 14,516–96.
„ Skipton, Mr. Dewhurst, 14,800–63.
And see *Dyers, Woollen Manufacturers.*

WORTH RIVER, 13,178–84, 13,188–94.

WRIGHT, Dr. (of Wakefield):
Evidence of, 2171–98.

WRIGLEY, Mr. (of Huddersfield):
Evidence of, 5004–113.

Y.

YEWDALL, Mr. Alderman (of Leeds):
Evidence of, 7163–7299.

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